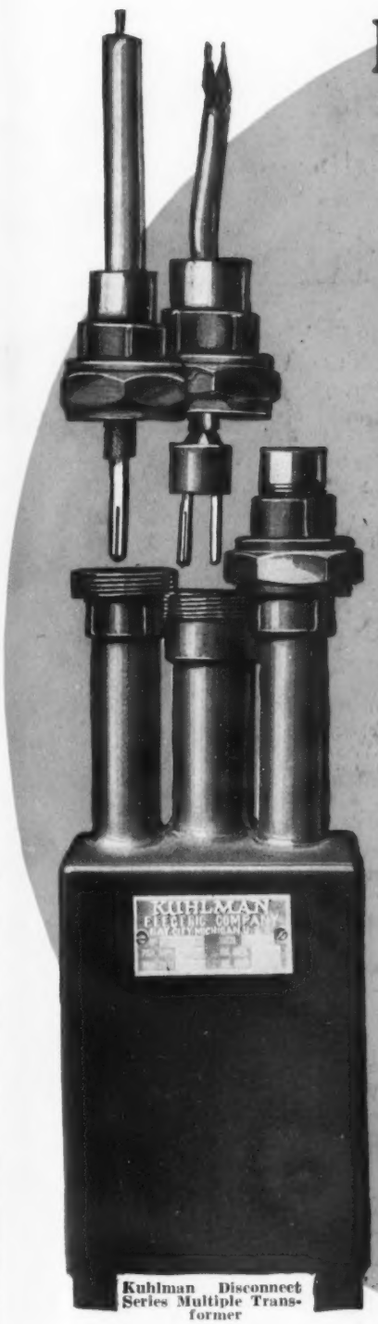
SEP 20 1922

Electrical World

McGraw-Hill Company, Inc. New York, September 23, 1922 Twenty-five Cents a Copy



Kuhlman Disconnect Series Multiple Transformer

New Total Disconnecting Type Series-Multiple Transformer

Built to meet the most exacting requirements of street lighting work—the most recent addition to the standard line of

KUHLMAN
TRANSFORMERS

Entirely Waterproof: This new transformer is so absolutely proof against moisture that it can be used under water, or under ground, as well as in ordinary service conditions.

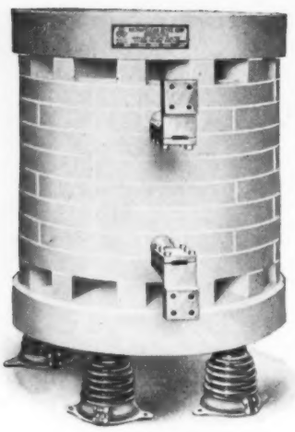
Simple, Rapid Connections: THREE minutes suffice to make or to break the NON-SPLICE connections with which this new transformer is fitted.

This new type of transformer is built expressly to meet the mechanical and electrical requirements that experience has shown to be vital in street lighting work. It is guaranteed to stand the severest tests under all conditions of practical use.

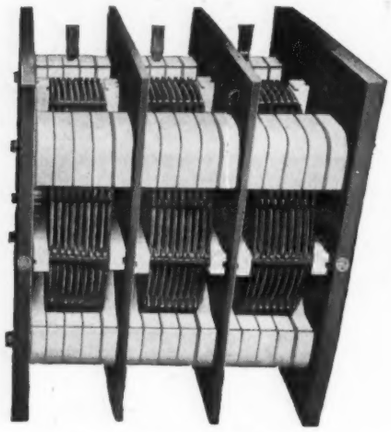
Write for Bulletin **113-*W***

KUHLMAN ELECTRIC CO., Bay City, Mich.

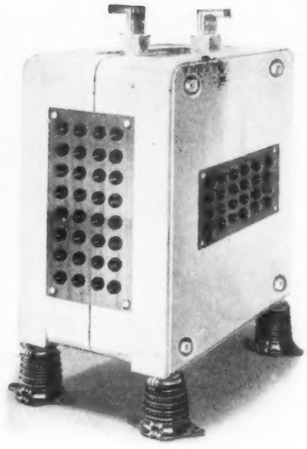
Manufacturers of All Types of Transformers



Indoor service
350 to 750 Amp.



Three-phase Feeder Coil



Indoor service 25 to 350 Amp.

Three Leaders That Top the Field

When a central station manager is in doubt as to the kind of current limiting reactors to install—it is a good idea to check up what equipment is used by the greatest and most economical generating plants in this country.

Metropolitan Reactors, for instance, are used by the big Edison Companies in New York, Boston, Chicago, Detroit, Brooklyn, etc. Also they are standard equipment not only in the central station but in the industrial field as well.

Short circuits cannot be prevented as yet, but you can do the next best thing, install Metropolitan Reactors and protect your equipment from abnormal and dangerous stresses. Just clip the coupon.

Partial List of Installations of Metropolitan Reactors

Brooklyn Rapid Transit Co., Brooklyn, N. Y.
Calgary Municipal Electric Co., Calgary, Canada
Canadian Niagara Falls Power Co., Niagara Falls, Ont.
Cataluna Power Co., Barcelona, Spain
Chicago, Lake Shore & South Bend R. R., Michigan City, Ind.
Cohoes Light & Power Corp., Cohoes, N. Y.
Commonwealth Edison Co., Chicago, Ill.
Consolidated Gas & Electric Co., Baltimore, Md.
Dayton Power & Light Co., Dayton, Ohio
East Hampton Gas Co., East Hampton, Mass.
Edison Electric Illuminating Co., Boston, Mass.
Edison Electric Illuminating Co., Brooklyn, N. Y.
Edison Illuminating Co., Detroit, Mich.
El Paso Power & Railroad Co., El Paso, Texas.
French General Electric Co., Paris, France.
Hydro-Electric Power Commission, Toronto, Ontario
Interborough Rapid Transit Co., New York, N. Y.
Joyce Gridland Railroad Co., London, England
Municipal Gas & Electric Co., Albany, N. Y.
New York Edison Co., New York, N. Y.
N. Y., N. H. & H. R. R. Co., West Farms, N. Y.
N. Y. & Queens Elec. Light & Power Co., Long Island City, N. Y.
Philadelphia Electric Co., Philadelphia, Pa.
Potomac Electric Co., Washington, D. C.
Public Works Department, Lake Cooleridge, New Zealand
Public Service Electric Co., Newark, N. J.
Shawinigan Hydro-Elec. Power Co., Shawinigan Falls, Ont.
Tennessee Power Co., Chattanooga, Tenn.
Toledo R. R. & Light Co., Toledo, Ohio
Toronto Power Co., Niagara Falls, Ont.
Turners Falls Power Co., Turners Falls, Mass.
United Electric Light & Power Co., Springfield, Mass.
United Electric Light & Power Co., New York, N. Y.
Union Gas & Electric Co., Cincinnati, Ohio
U. S. Explosives Plant, Nitro, West Va.
Utica Gas & Electric Co., Utica, N. Y.
Victoria Falls & Transvaal P. Co., Simmerpan, So. Africa
Warren & Co., Boston, Mass.
Youngstown Sheet & Tube Co., Youngstown, Ohio

CLIP THIS COUPON

METROPOLITAN DEVICE CORPORATION

1250 Atlantic Ave., Brooklyn, N. Y.

Gentlemen:—Please send data and full information on current limiting reactors.

NAME..... COMPANY.....

ADDRESS..... TITLE.....

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, Jr., Editor — HAROLD V. BOZELL, Editor

EARL E. WHITEHORNE, Commercial Editor — ALLEN M. PERRY, Engineering Editor — L. W. W. MORROW, Associate Editor — J. C. MARTIN, Western Editor — ROBERT SIBLEY, Pacific Coast Editorial Director — H. S. KNOWLTON, New England Editor — ROBERT M. DAVIS, Statistical Editor

T. P. KINDIG, Associate Commercial Editor — H. M. CUNNINGTON, Trade and Markets Editor — R. L. SHEPHERD, Assistant Engineering Editor — H. C. ANDERSON, Assistant Western Editor — PAUL WOOTON, Washington Representative — F. C. WELLS, Associate News Editor

Volume 80 — New York, Saturday, September 23, 1922 — *Number* 13

Is Your Family United?

EVERY man in the electrical industry today believes in co-operation. It goes without saying that the local electrical family in every community should organize and harmonize its interests, purposes and policies so that the public will see electrical men agreed on principles and working together in friendly accord.

So well has this been demonstrated that the local electrical league is recognized as the very keystone of the present movement to electrify America for which the entire industry is working. The Joint Committee for Business Development has enlisted the members of the Electrical Supply Jobbers' Association and the National Association of Electrical Contractor-Dealers in the taking of a census for the purpose of determining the best men in every town to lead and form a nucleus of local co-operative associations. The foundation of the movement is to be laid right there.

But what of the cities that already have leagues?

THERE are three kinds of situations in these centers where the local electrical families are already organized. Some are alive and active and doing good work. They will go on and increase their influence under the stimulus of the national campaign. Some are dead and doing nothing. They must be awakened, revitalized and set to some interesting constructive purpose. But there is still another class.

This third class offers the most difficult problem in the whole program of organizing local co-operation. They are the divided leagues in a number of the larger cities—the leagues that have been longest organized and are now split into two camps, with probably the central station and the jobbers on one side and the contractor-dealers on the other. Because of the traditions grown out of past conflicts between antagonistic personalities they refuse to play—or work—together.

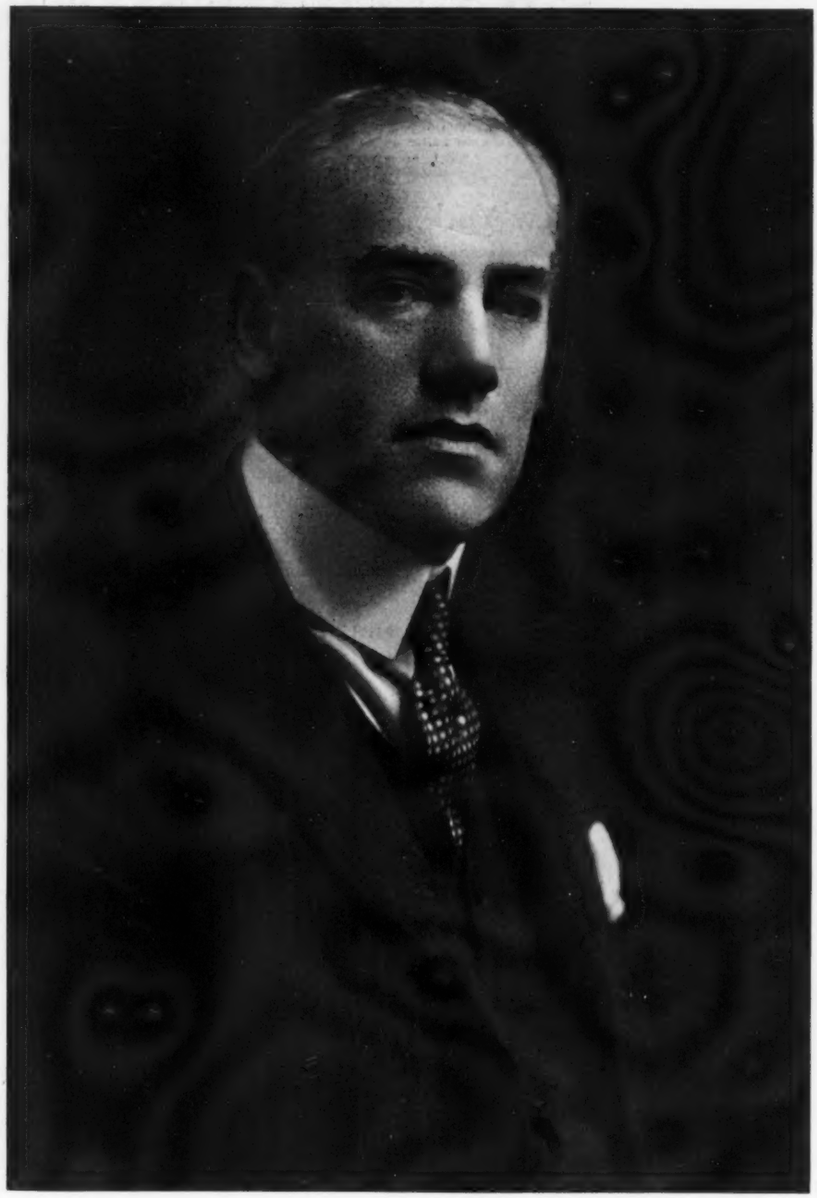
Their interests are the same. They are absolutely interdependent. In the minds of the public they are inseparably linked together as "electrical men." But neither will follow the other's lead in any project, and so electrical development in that community walks on one foot and makes slow progress.

WE HAVE a common responsibility in all of this, we electrical men. Either we believe in co-operation or we don't; and if we are for it at all, it is a principle worth promoting in our own towns. If we have no league, therefore, we must aid in getting one started. If our league is dead, we must help man the pulmotor. And if we live in a divided family, there is an even greater thing to do.

Some one must lead these two opposing clubs into a bigger, better, more ambitious organization, where the contentious past may be forgotten in progressive plans and creative activities that offer both groups more interesting opportunity and more profitable achievement. Who is the man? We must go to him now, convince him that it is his job and offer to help.

John E. Zimmermann

Consulting engineer, public utility executive and business man, who is the operating head of many properties controlled by leading financial interests.



THE marvelous growth and splendid standing of electric light and power enterprises in this country have resulted from action taken by farseeing executives in the industry in co-operation with skilled engineers and financiers. The outstanding fact about John E. Zimmermann is that he is a public utility executive and operating head of many properties managed for leading financial interests in this country.

The properties that are under Day & Zimmermann management and are under Mr. Zimmermann's personal direction serve communities in Ohio, Indiana, Pennsylvania, Delaware, Maryland, District of Columbia, Virginia, Georgia and Alabama and include electric light and power systems, electric railways, gas plants and steam-heating systems. Mr. Zimmermann has served as consultant in executive problems relating to utilities and industrial establishments and has negotiated several of the larger power contracts that have been executed between utilities.

Previous to entering the public utility field Mr. Zimmermann's experience as an engineer included the direction of the construction of industrial plants and the direction and administration of manufacturing. He is vice-president of Day & Zimmermann, Inc., New York City, and serves as an officer or director of a large number of public utilities where his executive talents have been utilized to develop and extend the properties.

Mr. Zimmermann was born at Buenos Aires, Argentine Republic, on Jan. 31, 1874. He was graduated from the National College in Buenos Aires in 1894 and later studied at the University of Buenos Aires and at the University of Pennsylvania. He served as mechanical engineering apprentice in the shops of the Great Southern Railway and later was employed as an engineer and chemist with other Argentine companies.

Upon his arrival in this country Mr. Zimmermann became connected with the George V. Cresson Company of Philadelphia, and then with the American Pulley Company as superintendent of construction of its new plant. Later he became secretary of the company, in charge of manufacturing. In 1907 he became a member of the engineering firm of Dodge & Day, now Day & Zimmermann, Inc. He is a member of the N. E. L. A., the A. S. M. E., the Franklin Institute, the Newcomen Society (London), the Pennsylvania Historical Society and the Pennsylvania Museum and School of Industrial Art.

Editorial Comment

Electrical World, September 23, 1922

Volume 80 Number 13

Another Case of Bung and Spigot

A CALLER in the office of a utility the other day sat waiting for the general manager to come out of a conference. He sat not far from the cashier's window and listened to his conversations with the customers who came in to pay or to discuss their bills. The man at the cashier's grill was not cordial, he was not courteous, he was not agreeable, he was not attentive, he was not careful to explain away fully, clearly and satisfactorily the misunderstandings that were brought to him. In other words, he failed to make himself an influence for friendship; he became an influence for discontent, sowing seeds of trouble among countless customers.

The visitor was greeted by the general manager in a few minutes with apologies for having kept him waiting and the explanation that the chief officials had been gathered with the president. They had been discussing the promotion of good will and laying plans for better personal service. And while these high-priced men were talking in the upper room, their honest purposes were being double-crossed by an unguided employee below.

Time for Complete Analysis of Rural-Service Costs

IN ALL the talk about the cost of rural service there has been little or nothing done in the way of a clean-cut analysis of the costs of the service from the foundation up. By this is meant a study that extends back to the power house and ends with a statement of the total cost of all items involved in the service. The practices in financing and maintaining the few lines that exist have been such as more or less to obscure the total costs, because, under the existing conditions, it has been necessary for the consumer to carry a part of the burden and the costs of that burden have not been reduced to the dollars-and-cents cost to the consumer. The cleanest-cut study yet made public has been made in Iowa, and on another page will be found the results of that study embodied in an article by W. J. Greene.

Very soon it will be necessary for the central-station executive to face this problem on the same basis as that on which other central-station business rests. Probably that means the financing of the lines by the utility. It also means that the customer must pay the cost of the service. Central-station commercial departments cannot afford to face the issue without having first made a thorough analysis of the factors that go to make up cost. It is entirely likely that every plan now in use will be subjected to searching scrutiny, and if any weak spots are present, they will be found. The analysis presented in Mr. Greene's article is important because it dodges no issue but, on the other hand, brings out costs of service that are likely to make some men who are attempting to give rural service dodge. There is no reason, however, why they should dodge or why they should fear the figures. The costs are there regardless of how the service is obtained, and unless the facts are faced, an unpleasant reckoning will sooner or later be necessary. There are many cases to be found now where a failure to face the situation has produced serious results, and some executives have on their hands a problem they are without any means of handling successfully. A careful study of the figures in Mr. Greene's article and an analysis of individual situations in the same way will be well repaid.

Some Reasons for Government Interference in Business

AN INDIANA coal operator has been quoted in Chicago papers as making the declaration that enough would be added to the price of coal to insure that the losses of the strike shall be paid by the consumer by next April. A similar statement was made about the same time by a prominent Iowa operator. The assertions do not convey anything new to those who have thought seriously about the situation created by the coal and rail strikes. To those who have not paused to think as well as to those who have, however, such avowals have much the effect of waving a red rag at a bull. All through both strikes many who have been prominent in the public eye have taken a very frank "public-be-damned" attitude, buried, it is true, under a thin camouflage of solicitude for the public good.

It is not many years since the same attitude displayed in these two strikes was all too prevalent in the utility field in matters other than labor controversies. This was conspicuously the case with steam railroads. The result was their regulation by the Interstate Commerce Commission and a general placing of other utilities in the hands of state commissions. Whether the control exercised by governmental agencies is good or bad may be open to debate, but there can be no debate as to the responsibility for the acts which led to such control. The biggest single agency which brought it about was the attitude of mind of those at the head of the business enterprises themselves. The coal industry is rapidly shaping its course so as to bring governmental control that may be good or bad economically. If it comes, neither the owners nor the labor unions will have the power to produce such a situation as that now existing. In the railroad field the actions of labor unions and railroad managements that have produced the present situation are steadily forcing governmental control. Whether such a course be economically right or economically wrong, a continuation of present conditions will compel that such a course be taken.

When such control shall be a fact the industries involved will have only themselves to thank. Today they

have in their hands the decision as to whether the government shall withdraw from further interference in their business or whether its activities shall be increased.

All of the activities of radicals and the efforts of political demagogues, bad as they seem, can do little to cause such interference unless the businesses concerned play into their hands. It will pay the interests which are so vociferous about government interference in business to study carefully the reasons why some industries are already under strict governmental regulation.

Economics and Sentiment in Accident Prevention

A HEALTHY tone in the discussion at the National Safety Council meetings in Detroit was observable in that the two principal motives for safety work in industry were properly balanced. These motives are the humanitarian and the economic. Two extreme views of such work are quite likely to be found in any discussion and to lead to serious error. The first is the cold-blooded idea that would balance life and limb against the expense account and sacrifice the welfare of employees unless the balance sheet shows a net profit on safety work. The second is the idea of the sentimentalist who resents the consideration of expense and insists on extreme measures for safety at any cost. One holding this view is quite likely to insist that safety is paramount to everything else and to champion entirely impracticable plans. Either of these extreme views defeats its own ends.

Accident prevention and safety work must be devoted to throwing every reasonable precaution around the work of the shop and the field so that human life and limb shall be protected. In this the question as to whether a few dollars shall be saved and injury to human bodies risked must not enter. If there is a real risk, the cost to industry of eliminating that risk is a justifiable cost. In such work must be included education of the workmen, as one of the most serious problems in any accident prevention program is the protection of men against their own acts and propensity to take chances. On the other hand, there is a very real economic problem that must be considered. Only half of this problem is reflected in the financial balance sheets of industry. That half is the cost of accident prevention and the saving in direct cost of accidents. The other half is the cost of accidents to the men who are the victims. Accident prevention to them and to their families is a direct gain by reason of the saving of life, limb and suffering for which no sum of money can compensate.

To both employer and employee accident prevention has a very real and very valuable economic aspect. Accident prevention, with all the good work that has been done for it in the past twenty years, is neither a matter of cold-blooded calculation on a dollars-and-cents basis nor a matter of sheer sentiment. It is an intensely practical question as to how the tasks of industry can be accomplished so that the greatest measure of human happiness and welfare can be attained with the minimum of suffering. Its results must not be judged either exclusively in money saved or exclusively from the point of humanitarian sentiment, but through a properly balanced consideration of both.

The 165,000-Volt Caribou Development

NOT the least of the achievements of the last year or two in electrical engineering has been that of the Great Western Power Company of California, which in its Caribou development has broken two records and has paved the way for still further progress. The two advances made in this station, although not large steps in themselves, have been important. The first concerns the size of the impulse wheels. These are rated at 15,000 hp. each, two of them being connected to each generator. The effective performance of these wheels has been noted with the greatest interest.

The transmission line, while nominally its tension is only 15,000 volts higher than that of other lines already in operation, is marked by the first extensive use of static shields to reduce the voltage duty of the insulator units nearest the line conductor. It having been found that the troublesome flashovers to which high-voltage lines are subject have been due largely to overstressing of the line units and subsequent cascading of the entire string of insulators, it was thus necessary to reduce the voltage drop across these particular units.

The reason the line end unit has a higher voltage duty is that it must carry the charging current for the entire string of insulators, and inasmuch as its capacity is quite small the comparatively large flow of current results in an excessive potential drop across the unit. Two distinct methods of reducing this voltage duty have been advocated, one through the increase of the capacity of the units by increasing the superficial area of the metallic parts of the insulator, the other by means of static shields from which the excessive charging current for the insulator string would be carried to the second unit from the line conductor. In the case of the Caribou development it was considered most feasible to make use of a static shield. The success of this method of protecting the line end unit will mean much to the 220,000-volt transmission lines which will be placed in operation within the next two or three years in California.

Blind Alleys in the Teaching Profession

THIS is the time of the year when several hundreds of young men become college instructors and assistants in various branches of electrical and mechanical engineering. Some accept an appointment from a college in order to continue their studies, some like teaching, and to some it is just a "job." It is universally recognized that the training of future engineers should be intrusted to much more mature teachers than most American colleges are in a position to hire and the responsibility for such an unsatisfactory state of affairs rests on the country as a whole. But the young teachers themselves should clearly realize the highly responsible nature of their work and should lay out their plans and life aims accordingly.

A young instructor in engineering who neglects his pupils for the sake of his own advanced studies is just as undesirable as one who is so busy with his students or administrative work that he altogether neglects his own education. Both are headed for a blind alley of disappointments and regrets. Somewhere there is a balance between giving to the students from one's

own store of knowledge without adding to it and using the vast reservoir of accumulated scientific and professional wisdom for one's own profit only and failing to turn it to that of others.

A correct solution of the life problem of a young instructor in electrical engineering is not possible without a clear understanding of at least the following two propositions: (1) A teaching career is worth while only if continued for a number of years with the ultimate hope of rising into the ranks of the leading professors of the country; (2) success in teaching is inseparably connected with a constant untiring study of the fundamentals of the theory of electricity, from different points of view and in various applications. A young instructor who understands and follows these principles will study his fundamentals systematically, without haste, year after year, each year becoming a better teacher and a better authority for practical men. If we had more teachers of this type, the intellectual output of our large engineering colleges, both in men and in books and articles, would be much higher and we would no longer be referred to as a nation of salesmen.

Efforts for a Lighting Code in England

THE report of the British Home Office departmental committee on lighting of factories and workshops, which became available a short time ago, is the work of eight well-chosen experts. The results of their consideration of industrial lighting are of decided interest as compared with the work in this country which finally culminated in the American standard code of the Engineering Standards Committee. Any committee dealing with this particular subject in the present state of industrial organization finds itself between the devil and the deep sea. It is spurred in one direction by the desire to enforce good illumination and in the other by lack of funds and the stubborn opposition of certain classes of large manufacturers who are willing to sacrifice nearly anything belonging to their workmen to save a little trouble and expense. The result is that while in some respects the British committee has gone further in its recommendations than has American code practice, in others it has stopped far short of doing anything efficient.

For example, an illumination of not less than 0.25 foot-candle is required not only at the floor level over working areas, but in all open exterior workplaces and in ways leading thereto which may be considered to require it; and, specifically, in all working spaces and spaces ordinarily traversed in iron foundries 0.4 foot-candle is required at the floor level. Only a few definite things were taken up in the preliminary report of 1915, but in the second report (1920) the English committee, in preventing glare, went to the length of requiring unshaded lamps to be kept down to an intrinsic brightness of not more than 5 candles per square inch and requiring a cut-off of 20 degrees for all lamps within 100 feet of the workman, to be increased to 30 degrees for lamps within 6 feet of the workman. This requirement is a long way beyond the recommendations of the American code, and in the right direction.

The present report is an attempt to investigate and define adequate illumination for certain processes carried out in factories and workshops, but the committee has not gone far, lacking funds and opportunity for obtaining information. The most interesting feature of the few studies which were made was the effort to ascertain the effect of mixed artificial and natural illumination, concerning which no definite information was finally obtained either to confirm or to disprove the impression, general here, that such a mixture is decidedly trying.

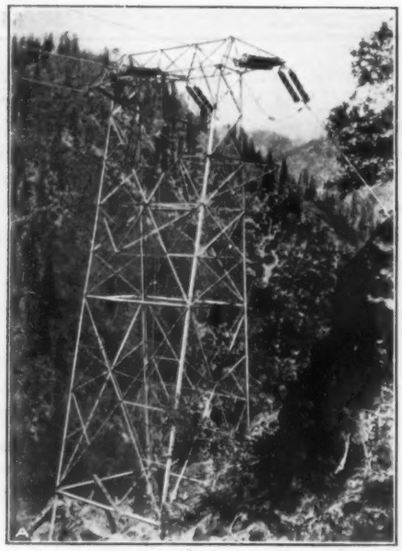
The English committee has tried to classify the types of work requiring illumination under three subdivisions —ordinary work, fine work and very fine work. The recommendations for the two latter classes were 3 foot-candles and 5 foot-candles respectively. But clearly the details of the investigations were not thorough enough to permit recommending any specific intensities for work which would be classified here as rough. One interesting study was made in needlework, the results of which are worth quoting. The particular task was making buttonholes, and the special features to be emphasized are that whereas on white material 3 foot-candles of artificial light was regarded as somewhat insufficient, on black material 6 foot-candles was decidedly too low to permit continuous work, and that this intensity of daylight illumination was materially better than artificial lighting. All of this is quite in keeping with the indications obtained in this country that it is extremely difficult to get light enough when black materials are being worked.

In general, the English committee, although handicapped in divers ways, has made excellent progress in the right direction so far as it has gone. It is feeling its way toward more complete requirements, and we fancy that its later reports, after it has had opportunity for further investigation, will carry it to substantially the same goal that the American Engineering Standards Committee has already reached.

Remote Control of Plant Apparatus by Radio

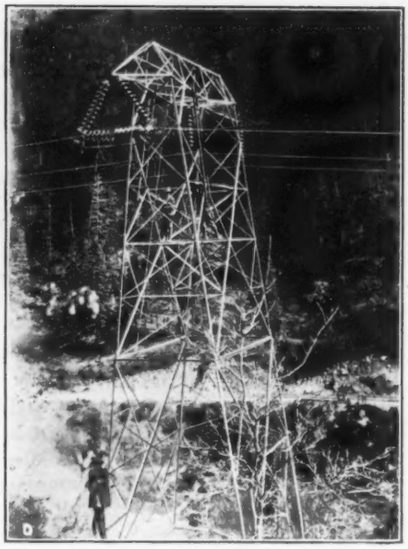
REMOTE control of plant apparatus by radio has been attracting keen attention among central-station men and has been stimulated by the press reports of the control by this means of oceangoing vessels, as well as by some reports regarding land vehicles that have lately appeared. Of course, some means of translating radio signals into a form that can be utilized in operating switches or other control apparatus is the first necessity, since in the present development of radio apparatus sufficient power to perform the operations directly cannot be transmitted by any known means. Relays that will act as a translating device have recently appeared on the market, largely for use in recording telegraph code signals, and it is possible that they might be utilized to receive and translate remote-control signals. One of these devices, the product of the radio laboratory of the Bureau of Standards, is of particular interest to the central-station man who must study remote-control problems because of its simplicity and the lack of delicate adjustments and from the fact that in one form it dispenses with the use of batteries.

The whole problem is hardly out of the region of speculation, and for some time to come any work done will be frankly experimental. Some promising developments have been made in the naval control field, and the men who like to experiment with such problems cannot afford to overlook the relay development mentioned.



A—Erecting dead-ends and jumper loops on snow towers.

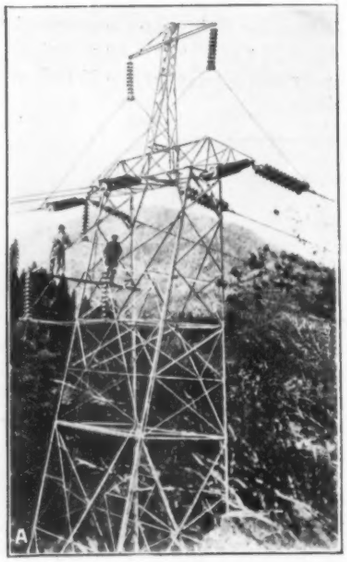
B—View showing reels along the railroad track and conductors being pulled out to right-of-way several hundred feet above on the mountain side.



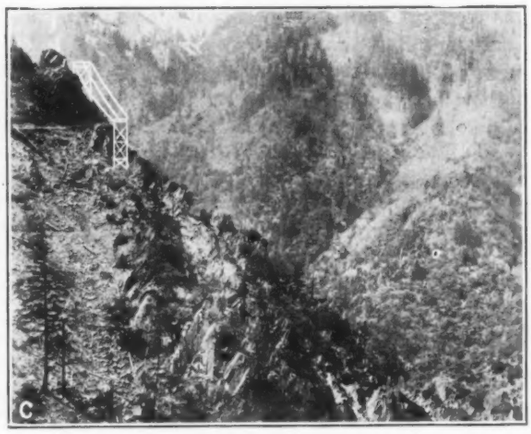
C—Pulling machine in operation drawing in conductors from along railroad track. Note re-reeling device in operation alongside the pulling in drum.

D—Installing section switches which are used for line testing.

Mountainous Country and Hazards from Sleet and Snow Made Caribou Development Particularly Difficult



THE first 50 miles of 165,000-volt transmission line which the great Western Power Company has constructed from its new Caribou development had to be erected over mountains about as rough as any across which lines can be built. Furthermore, portions of the line are subjected to very severe sleet storms which make the tower and line construction requirements even more rigorous. Some of the difficulties encountered and methods of overcoming them are illustrated on this page and discussed more at length on following pages. The flat construction used in the higher regions, the transposition arrangements and long-span insulators are interesting.



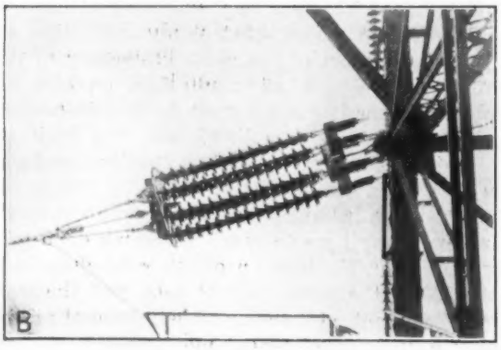
A—Transposition tower-flat construction.

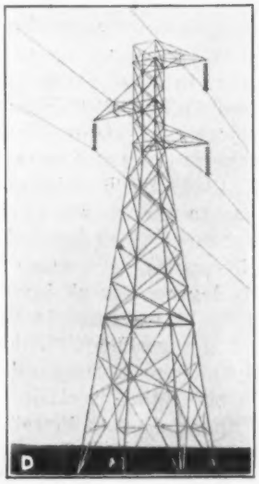
B—Dead-end insulator on Carquinez span (length 4,753 ft.), consisting of eight strings each of fifteen standard 10-in. units. Normal stress on insulator, 8 tons; maximum stress, 10 tons.

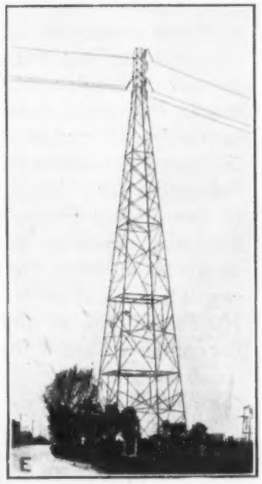
C—View of the canyon taken in the eleventh mile. Note location of two towers in the upper left-hand corner and main line of Western Pacific Transcontinental railroad in the lower right-hand corner.

D—Standard tower in valley section.

E—Crossing tower used on Sacramento River—navigable stream.







Caribou 165,000-Volt Development

Noted for Its 15,000-Hp. Impulse Wheels, Its High-Voltage Lines Over Exceptionally Rugged Country and Method of Handling Work and Distributing Material

By J. A. KOONTZ
Electrical Engineer Great Western Power Company

THE Caribou station of the Great Western Power Company of California, which was put in service in 1921, is the largest of a series of developments that will ultimately utilize the water power on the north fork of the Feather River between the storage reservoir of Lake Almanor and the Sacramento Valley at Oroville. This section of the river has a drop of 4,300 ft. (1,310 m.) with a developed storage reservoir capacity of 300,000 acre-ft. (369,000,000 cu.m.), and by raising the dam an additional 45 ft. (13.7 m.) the reservoir will have a capacity of 1,250,000 acre-ft. (1,543,500,000 cu.m.), with the spillway crest at an elevation of 4,500 ft. (1,356 m.) above sea level.

Water for the station is brought from Lake Almanor through an 11,200-ft. (3,413-m.) tunnel of 7-ft. x 7-ft. (2.13-m. x 2.13-m.) section to Butt Valley, where it is permitted to flow down Butt Creek for about 6 miles (9.65 km.) to the intake reservoir of 1,700 acre-ft. (2,091,000 cu.m.) capacity, whence it is again taken through a tunnel 9,200 ft. (2,804 m.) in length to the top of the hill above the station.

The second tunnel, No. 2, is of circular section, is lined with concrete and is 10 ft. (3 m.) inside diameter. It terminates in a pressure tunnel and is connected to a 30-ft. (9.14-m.) cylindrical surge chamber. This surge chamber extends 50 ft. (15.2 m.) above the normal water level. The pressure tunnel has been driven through the rock for the first 100 ft. (30.4 m.) of head with a slope of 28 deg. The pressure tunnel was first lined with heavy reinforced concrete, then with a $\frac{3}{16}$-in (4.7-mm.) steel tube of 11 ft. (3.35 m.) inside diameter, and finally with an 8-in. (21.5-cm.) protecting concrete belt on the inside of the steel. This pressure tunnel connects at the bottom with three steel pipes of 66 in. (1.68 m.) inside diameter, two of which extend down the hill and are later reduced to a diameter of 60 in. (1.52 m.). Later each 60-in. pipe is connected into a "Y," where they later branch into two 42-in. (1.07-m.) pipe lines, each of the latter being for a single wheel and two impulse wheels for each generator. The effective head on the wheels is 1,010 ft. (307.8 m.) under load conditions, and the 22,223-kva. units are driven by two wheels. The units are of the two-bearing type. At present only two of the three pipe lines are installed, the third being capped to be utilized when the third unit is installed.

Each impulse wheel is driven by a single 11-in. (28-cm.) water jet which is controlled by a needle and independent governor. Each waterwheel can be operated independently and is capable of carrying half the generator load. The wheels are rated at 15,000 hp., but from test they are known to develop over 16,000 hp. Each nozzle has its own relief valve actuated by the governor and by pressure, so that any wide fluctuations of load or abnormal pressure rises will open the relief valves and relieve the surge conditions. The water pressure in the pipe lines just ahead of the nozzle is 446 lb. per square inch (32.6 kg. per sq.cm.) at full load.

The power house is designed ultimately to accommodate six 22,223-kva. units and to deliver power at 165,000 volts to three outgoing lines. Additional space is provided for one incoming high-tension line which will carry approximately 25,000 kw. from a station to be located at the mouth of tunnel No. 1, where more than 200 ft. (60 m.) of head is capable of being utilized.

The generators are three-phase, 60-cycle, 11,000-volt and operate at 171.4 r.p.m. They are capable of charging 190 miles (305.7 km.) of 165,000-volt line without becoming self-excited.

At present the station has two 600-kw., 250-volt com-

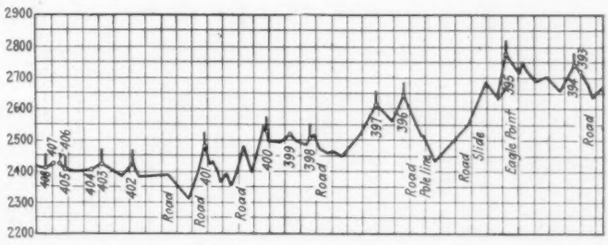


FIG. 1—A COMPREHENSIVE PROFILE OF THE LINE LOCATION WAS OF GREAT AID IN PLACING MATERIAL

On the actual profiles were indicated the horizontal angles, type of insulator connections, tower footings, extensions and type of tower. A section of the profile was given to the foreman on each portion of the line.

pound interpolar direct-current generators for exciting purposes. Ultimately an additional set will be installed. Each of these exciters is driven by a motor and waterwheel, while the third will be driven by an induction motor. Any two of the sets will have ample capacity for furnishing the entire excitation for the station.

One bank of three 7,500-kva. single-phase transformers is used for each generating unit. The transformers are delta-connected on the 11,000-volt side and star-connected on the high-voltage side with the neutrals permanently grounded without resistance. These transformers are of the oil-insulated, water-cooled type.

In designing the station, provision has been made for double buses on both the high-tension and the low-tension side, and the 11,000-volt buses will ultimately be sectionalized with 8 per cent, 22,000-kva. reactors to reduce the short-circuit current which may be handled by the breakers.

The 11,000-volt buses are installed in separate rooms and in addition each bus is again separated by barrier doors into groups of three switches each. This scheme was utilized in an attempt to try to isolate trouble should it ever occur in a particular section. The same general scheme is carried out on the high-tension side, each 165,000-volt bus being on a separate floor and the switches set in concrete compartments.

The power-house building is 120 ft. (36.5 m.) high, 104 ft. (31.6 m.) wide, and the present length is 176 ft. (53.6 m.). The ultimate length of the building will be slightly more than 308 ft. (93.8 m.). The building is of reinforced-concrete construction with a steel frame.

The question of the proper transmission voltage for use in connection with this development received serious consideration, and for numerous reasons the voltage was finally placed at 165,000 instead of a higher figure. Two of the principal reasons for the selection of this voltage were the decrease in the initial investment thus permitted and the ability to utilize developed and tested

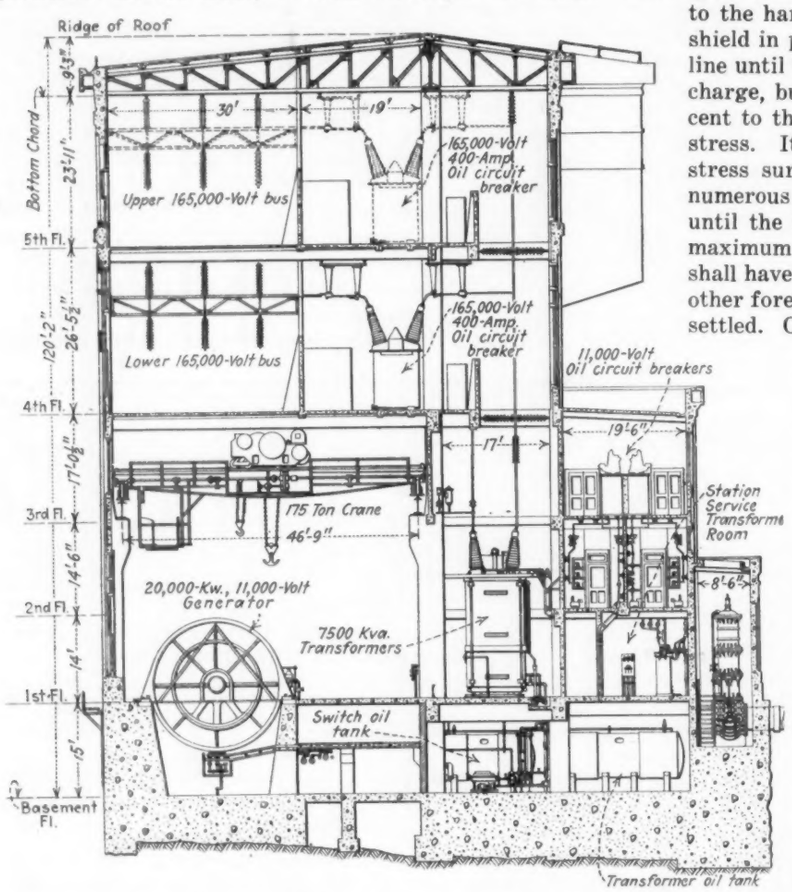


FIG. 2—SECTIONS THROUGH CARIBOU STATION INDICATE THE EXTENT TO WHICH IT HAS BEEN SAFEGUARDED AGAINST DISTURBANCES

equipment. This latter point was important at the time the Caribou work was started, which was just after the signing of the armistice and at a time when all manufacturing companies were working under difficulties and in no condition to attempt special development work.

As the most serious problem in connection with a high-voltage line is that of insulation, this problem had special attention. It has been shown from the experimental work of Prof. H. J. Ryan that when a suspension insulator string is composed of more than eight or nine units, depending on the physical dimensions, the addition of units to these strings will not reduce the voltage duty of the unit next the line wire for a given impressed voltage.

With this in mind, various schemes were considered and certain tests were made to determine the effectiveness of grading and the use of various guards and shields. Finally a flat 12-in. (30.5-cm.) disk with heavy rolled rims was selected. By the use of this shield the voltage duty on the first unit was reduced from 19,500 to 14,000 volts and the duty on the second unit was raised only from 14,500 to 15,000 volts. All other units, with the exception of those on the tower end, showed a slight reduction in voltage duty.

There are many modifications in shape and size which can be made in the guard shields or rings which will give additional improvement in voltage distribution, but for our particular case it was felt that this simple type would give us ample protection. It was readily attached to the hardware and simple to install. With this shield in place the voltage can be increased on the line until the conductor is covered with corona discharge, but the clamp and wire immediately adjacent to the clamp will be entirely free from overstress. It is hoped through this reduction of air stress surrounding the insulator attachment that numerous flashovers may be eliminated. However, until the line shall have been in operation at the maximum voltage for some time and the insulators shall have acquired the usual collection of dust and other foreign matter this point cannot be definitely settled. One of the main reasons for using a shield in place of the graded string was that use might be made of the standard 10-in. (25.4-cm.) short-coupled units which have been developed and made rather reliable. It was felt that if larger and specially developed units were used there was danger of serious depreciation of insulators.

The diameter of the line wire was selected so that the line would be practically free from corona loss at normal voltage and under normal weather conditions, and for the first time to the knowledge of the writer conductors of different diameter were used on different ends of the line. This was especially advantageous in this case, as there was approximately 15,000 volts additional between conductors at the generating end; but the power house is situated at 3,000 ft. (914 m.) above sea level, this altitude gradually decreasing from the generating station until at Oroville, 50 miles (80.4 km.), there is a sudden drop from 1,500 ft. (457 m.) elevation to about 250 ft. (76.2 m.), the remainder of the line being at less than 500 ft. (152 m.) above sea level. At Oroville the diameter of the wire was changed from 0.86 in. (2.19 cm.) to 0.74 in. (1.88 cm.).

The cable used throughout the line was thirty-seven-strand steel-cored aluminum cable, consisting of thirty strands of aluminum and seven of steel, the smaller cable having a conductivity equal to No. 4/0 copper.

Throughout the mountain section, which is subject to sleet, single-circuit towers were used with conductors in a horizontal plane. This section covers the first 50 miles (80.4 km.) of line and is in the Feather River Canyon, which is about as rough a piece of mountain country as any in which a transmission line can be built.

In the valley section triangular construction was used. In stringing this section of line very few dead-ends were used, in fact only at points where the angle exceeded

20 deg., but at least once every mile "inverted V" construction was used. In general this construction was required by law on account of road or highway crossings, and it served for anchoring the line in place of the ordinary dead-ends. Because of past experience with dead-ends as few were used as possible.

On account of the rough nature of the country for the first 40 miles (64.3 km.) of line, a complete profile and tower location map was plotted, as shown in the drawing. The tower locations were made by use of a parabola template on this profile, and the wire was sketched in approximately to its true location. On this profile also were placed the horizontal angles, the type of insulator connections (whether suspension, tie-downs, "V" or dead ends), the tower footings, the extensions could be lifted by its own power onto a push car and pulled down the track.

In stringing the conductors, at first a $\frac{3}{8}$-in. (9.5-mm.) plow-steel messenger or pilot line was strung out in about 600-ft. (182-m.) lengths and threaded through the tower over suitable blocks. These lengths were equipped with an eye at each end which could be readily jointed to the adjacent sections. In this manner from 4,000 ft. to 8,000 ft. (1,200 m. to 2,400 m.) of line would be connected. At one end of this a special bridle was connected to the three aluminum conductors. The pilot line was then reeled in over the drum of the pulling machine and the conductors were drawn out. The insulators were hung in place before the conductor was pulled out, and a suitable roller-bearing sheave was

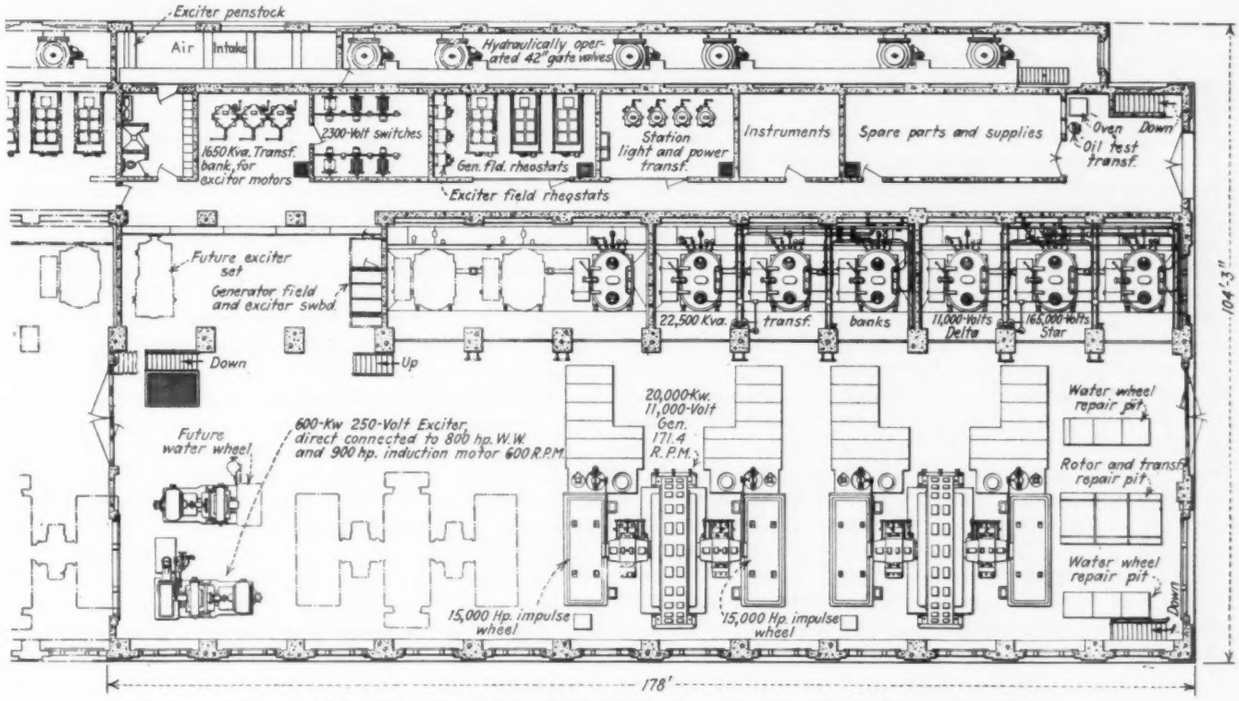


FIG. 3—UNIT TYPE ARRANGEMENT OF GENERATORS AND TRANSFORMERS PROVIDES FOR READY EXPANSION FROM TWO TO SIX GENERATORS

required for each footing, and it was indicated by the location of the footing diagram whether the tower was standard or anchored, the diagram for the standard tower being the square nearest the bottom of the drawing. This profile was found to be of great value throughout the work. A section of the profile was given to each foreman which covered his particular portion of line.

Throughout the mountain section it was necessary to devise special methods of handling the work and distributing materials. In many cases the track of the Western Pacific Railway was the only means of transportation. The material would be distributed by work train at the most accessible point, and from this it had often to be hauled up the mountain side by horses working along the railroad track or trails. At other places rope conveyors were installed.

Special pulling machines were developed for use in the first 12 miles (19.3 km.) of the line. These consisted of 6-hp. gas engines with twenty-to-one worm reduction, the worm driving two drums, one of 15-in. (38-cm.) diameter and the other of 7.5-in. (19-cm.) diameter. This machine was mounted on skids and placed at the bottom of the insulator string. When all three conductors were pulled up close to the tower, the outside conductors with their section of the bridle would be released and placed in the sheaves of their respective insulator strings. The bridle would be reconnected and the pulling continued.

After the conductors were threaded through the towers each one was pulled to approximate tension by the pulling machine and finally transferred to chain blocks for the final tension adjustment.

The pulling machine was so arranged that an empty reel could be placed on the side of the small drum and by running the free end of the cable around a sheave and back to this drum the 600-ft. (180-m.) length could be re-reeled as the cable was drawn through. These reels were of such size and weight that two men could handle them without difficulty.

One of the most difficult engineering and construction problems of the line was that of the crossing over the Carquinez Strait of the upper San Francisco Bay, where it was necessary to install a 4,753-ft. (1,442-m.) span, the wires of which had to clear the water 206 ft. (62.7 m.) at high tide. The wires cross not only the

strait but also a railway, a highway and a heavy telephone lead. These had all to be kept open at all times and not interfered with during the process of erecting the wires. The towers are similar, each being 195 ft. (59.4 m.) in height and carrying six wires, three on each side. The wires are spaced 20 ft. (6 m.) in the vertical and 35 ft. (10.6 m.) in the horizontal plane.

Because of the ease of testing and making replacements and renewals the supporting insulators were composed of eight strings of modern 10-in. (25.4-cm.) suspension units, each string consisting of fifteen units. The eight strings are attached at each end to a steel spider, which in turn is attached through eye bolts and cables to the conductor or tower. These attachments are so arranged that by take-up on the eye bolts slight variation in sag can be readily adjusted. On the tower end the individual strings of insulators are fastened to an eye bolt, this eye bolt running through a coil spring which comes in compression against the steel spider on the tower end of the insulator. These eye bolts are threaded, and by proper adjustment of the attached collars the spring tension and hence the load on the insulator strings can be adjusted. The springs used in this work were all carefully tested, and only springs having the same length and compression characteristics were used on the same conductor support, so that by careful measurement of the spring length there is no difficulty in knowing that the various strings are carrying their proper proportion of the load. The total load per conductor support varies from 16,000 lb. to 20,000 lb. (7,200 kg. to 9,000 kg.), depending on wind conditions.

The conductor is a sixty-one-strand cable consisting of thirty-seven strands of double-galvanized plow steel and twenty-four strands of aluminum, the aluminum forming the outer layer of the cable. The steel is depended upon to take care of the mechanical load and the aluminum to carry the electric currents. It was originally planned to use an all-steel cable, but it was found that for the same weight an all-steel cable would be equivalent to adding about 15 miles (24 km.) to the length of the transmission line, while with the steel-aluminum combination it would only be adding approximately 1 mile (1.6 km.).

Work Done at War Prices

The total cost of the Caribou plant, including tunnels sufficient for the operation of 96,000 hp. in generating equipment, has been approximately $12,800,000. The cost of the 165,000-volt steel transmission line from the Caribou station to the Carquinez Strait, including sectionalizing switch gear, was approximately $2,600,000.

It should be borne in mind that this work was done at war prices and that it was necessary to construct more than 9 miles (15 km.) of broad-gage railroad and 13 miles (21 km.) of narrow-gage railroad, together with four inclined railways; also 10 miles (16 km.) of 22,000-volt pole line. All of this work has been completed and can be utilized for the completion of the Caribou station and in the erection of a 25,000-kw. plant at the mouth of No. 1 tunnel and the next plant down stream from Caribou.

It is estimated that the third generating unit can be installed in the power house as now constructed for an additional cost of approximately $1,000,000. A total expenditure of $13,800,000 will therefore enable full utilization of the present capacity.

Because of the enormous storage in Lake Almanor this plant can be operated at its maximum capacity throughout the year, and therefore a better indication of the value of this plant as a producer of electrical energy can be found in the fact that on a basis of full operation the capital cost per 1,000 kw.-hr. of output is $30.44. When the third unit is installed the capital cost of the plant and waterway structures per 1,000 kw.-hr. of output will be reduced to $21.87. Even the installation of the third unit will give only one-half of the ultimate plant capacity.

Constitution or Soviet?

A Denunciation of the Domination by a Minority of the People that Urban Growth Has Made Possible in This Country

BY DR. LOUIS BELL
Consulting Engineer, Boston

THE long deadlock in transportation and coal production now disappearing was no new phenomenon, nor did it display any exceptional features save in its unusually severe bearing on the community at large. It is of no importance here to consider the exact merits of the controversy, the provocation on both sides or the litigious spirit displayed. The point which is important to determine is whether the hundred million people of these United States who are not directly concerned in the struggle shall be made to suffer at the will of a comparatively small number of quarrelsome or stubborn fellow citizens. And more than all it is necessary to discover whether when such emergencies arise the government of the United States purposes to pursue a policy of pussyfooting in the face of danger to 95 per cent of its citizens and to resign, in effect, the powers of government into the hands of private organizations, whether of employers or employees.

We sometimes forget to what extent civilization has degenerated into a condition of unnecessary and dangerous dependence on inconsequentials. Under our modern industrial system, with a program of distribution enormously more intricate and expensive than is in the least necessary, it has become possible for a very small minority of the people to inflict almost unlimited damage on the remainder if they are permitted to do so.

I hold no brief for or against the trade unions as such. I believe that on the whole they have had a good effect by checking, after long struggles, child labor, the twelve-hour day, the company store and other evils and pushing active reform as against the efforts of the baser sort of industrialism. But, as things are in the present organization of society, the average man can be preyed upon in a way that constitutional representative government should make absolutely impossible. For example, suppose, on the one hand, that there should be a general strike of all plumbers or, on the other, a lockout of all grocers on the part of the provision magnates. Either situation would render at least the large cities of the country absolutely uninhabitable within ninety days, and the law has no hold on the trade in provisions, while it has actually played into the hands of the plumbers in some states by restrictive legislation which would make it impossible, without a special session of the Legislature, to permit repairs by any person not of their consecrated body.

The utter dependence of great aggregations of humanity upon transportation of fuel and food, and upon the ministrations of a relatively few trades, in them-

selves unimportant save as they affect city dwellers, has written an entirely new chapter into political economy and one which is generally forgotten until some such crisis as the coal strike blazons it on the understanding.

To go further, half of humanity, so far at least as this country is concerned, has put itself in a condition of base servility as regards the necessities of life. Only a relatively small proportion of any large urban community is actually engaged in any personal labor, physical or mental, which is in any proper sense necessary to our civilization. Any big city is full of people who are willing to do anything and everything except definite, hard, productive work. Thousands of them are struggling along in retail business, barely able to make both ends meet, or are doing really menial tasks in trading in things good, bad and indifferent, necessary and unnecessary, anything in fact to keep from putting hand to tool and learning how to use it for production.

If one were to compare the number of pupils in real and alleged business schools learning how to sell things to people who do not want them with the total of young men and women who are learning any productive trade or studying any useful profession, the result of the comparison would be appalling. It is a commonplace saying that all the professions are crowded, but trade is ten times more so.

The result of all this is that the inhabitants of a large city are almost wholly dependent on external aid. There are probably a couple of million retail establishments for the sale of various things, tangible and intangible, in the United States, the official return on a comparatively small number of kinds of trade actually running over a million. So, in general terms, there are only fifty or sixty persons at most to carry a shop, and under existing industrial conditions nearly everything which is sold at these two million places is the product of much transportation, back and forth, up and down, sidewise and crosswise, all over this and adjoining countries.

The net result of this enormously complicated system of transportation and distribution reduces those who are from choice or necessity congregated in great communities to a condition of dog-eat-dog in obtaining their daily bread and of absolute dependence on transportation for the materials of this ration. Hence it is here that the recent situation, with its menace of cutting off food and fuel supply, takes on its most serious aspect, and the vital question is how far, in a representative government under a constitution, we are going toward the enslavement of the vast majority of the people to the will of small and quarrelsome factions.

Are we going to have a constitutional government obeyed by all in the interest of all, or are we going to have what is virtually a soviet government set up and maintained in defiance of the constituted authorities? To be sure, one may say that those who decline to produce have brought themselves willfully into a condition of dependence, but it is certain that they will neither freeze nor starve with becoming cheerfulness, and if eventually they rise in anger, they are a power to be reckoned with even by the most insolent and lawless.

We have come at present pretty nearly to the parting of the ways, where we must choose between a constitutional government and an irresponsible soviet. Shall we carry on at all hazards the government established by the fathers of the Republic or shall we have a government set up with violence by small minorities? This is a question that is squarely up to the powers at Washington.

How far political expediency will tempt them further to shuffle in inactivity remains to be seen. We know what Roosevelt did in the previous local strike and what Grover Cleveland did in the railway riots a score of years before. Neither Roosevelt nor Cleveland stopped to argue the ultimate details of the controversies with which they had to deal, each realizing that his duty was to protect from wanton injury, by whatever party inflicted, the people of the country over which he had been set on guard, and both acted promptly and effectively.

The situation has been quite as grave as at either of these previous crises. The influx of population into the cities at the expense of the country, and hence more groveling dependence on transportation, has been steadily increasing. The forces of disorder are more numerous and dangerous. The ferment of anarchy has been working more and more actively and generally. The conservative powers have grown more and more reactionary, striving incessantly to load the safety valve instead of letting down the fires, and for the possible results we have to look almost anywhere across the Atlantic.

Greater than any combinations of so-called labor and capital is the ultimate power of the body of the people who decline to be the victims of either. And it is high time that this power of last resort bore in upon the government, which is its creature, the lesson that the necessity of self-preservation transcends all the petty precepts of expediency.

SHOULD DEMAND ACTION

In a constructive way the civic organizations of the country should realize the danger and serve notice on Washington that no man and no party can disregard public safety without being cast into outer darkness. They should demand that rioting as an economic argument should be put down with an iron hand and that there should be constituted a tribunal, call it what you like, to pass upon disputes which endanger public safety and with power to enforce its decrees. A scheme of arbitration which litigants may flout at will is merely an incentive to anarchy.

Union men, who are on the whole law-abiding like their neighbors, will suffer cold and hunger with them if anarchy triumphs, and should not defend, even by implication, its sinister activities. They stoutly maintain that acts of violence come from vicious outsiders and complain that guards are too often insolent thugs. It is certainly equally against the public welfare that disorder should flourish or that private armies of dubious character should be maintained to prevent it. With the dynamite planting of the Lawrence strike green in one's memory it is difficult to lay all crimes to strikers.

But there is a very simple touchstone to determine guilt, and the sooner it is in active use the better. As a matter of experience it has been uniformly shown that when hastily assembled private guards are replaced by regulars, with orders to shoot, acts of violence suddenly cease. When the malefactors are suppressed the coroner can determine their identity at his leisure. Heaven forbid that we should have government ownership of coal mines and railways, but a government that cannot find a way of effectually regulating both should have scant mercy at the hands of the electorate.

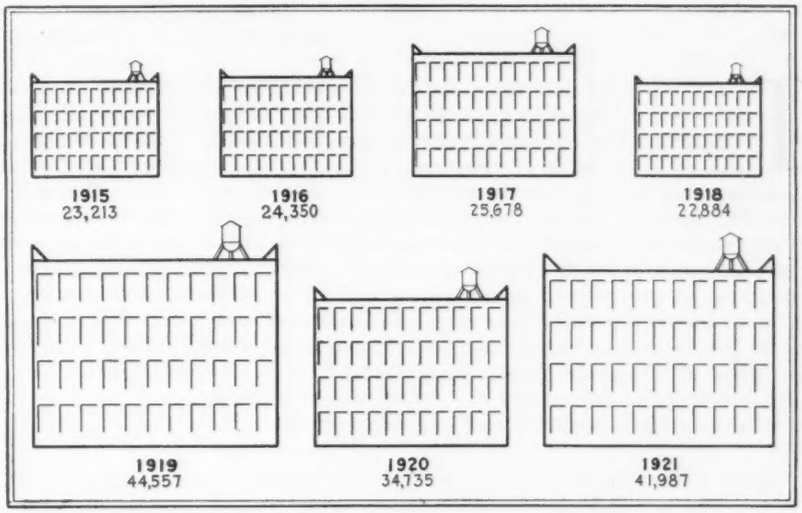
Industrial Power Customers Served by Electric Light and Power Companies

State and Section	Jan. 1, 1916			Jan. 1, 1917			Jan. 1, 1918			Jan. 1, 1919			Jan. 1, 1920			Jan. 1, 1921			Jan. 1, 1922		
	Total Number	New Customers During 1915	Per Cent Gain During 1915	Total Number	New Customers During 1916	Per Cent Gain During 1916	Total Number	New Customers During 1917	Per Cent Gain During 1917	Total Number	New Customers During 1918	Per Cent Gain During 1918	Total Number	New Customers During 1919	Per Cent Gain During 1919	Total Number	New Customers During 1920	Per Cent Gain During 1920	Total Number	New Customers During 1921	Per Cent Gain During 1921
United States	235,393	23,213	11.3	259,743	24,350	10.5	285,421	25,678	9.9	308,305	22,884	8.0	352,862	44,557	14.5	387,597	34,735	9.9	429,584	41,987	10.8
SECTIONS																					
New England	23,770	2,100	9.7	26,190	2,420	10.2	28,820	2,630	10.1	32,000	3,180	11.0	35,770	3,770	11.8	39,010	3,240	9.1	42,783	3,773	9.7
Middle Atlantic	37,500	3,720	11.0	41,920	4,420	11.8	44,040	2,120	5.1	50,636	6,590	15.0	56,600	5,970	11.8	62,260	5,660	10.0	73,050	10,790	17.3
South Atlantic	15,434	1,644	12.4	17,350	1,916	12.4	19,560	2,210	12.8	20,880	1,320	6.8	23,830	2,950	14.1	26,067	2,237	9.4	28,075	2,008	7.7
East North Central	67,000	4,370	7.0	73,330	6,330	9.5	79,450	6,120	8.4	82,890	3,440	4.3	95,180	12,290	14.8	103,690	8,510	9.0	113,970	10,280	9.9
West North Central	26,140	2,750	11.8	29,520	3,380	12.9	32,640	3,120	10.6	34,650	2,010	6.2	38,550	3,900	11.2	42,433	3,883	10.1	45,574	3,141	7.4
East South Central	6,960	610	9.6	7,450	490	7.1	8,030	580	6.7	8,290	260	3.2	9,580	1,290	15.5	10,271	691	7.2	11,063	792	7.7
West South Central	9,630	1,480	18.2	10,650	1,020	10.6	12,340	1,690	15.9	13,780	1,440	11.7	17,350	3,570	25.9	20,192	2,842	16.4	22,537	2,345	11.6
Mountain	8,539	949	12.4	9,013	474	5.6	10,391	1,378	15.3	10,755	364	3.5	11,402	647	6.0	12,704	1,302	11.4	14,232	1,528	12.0
Pacific	40,420	5,590	16.1	44,320	3,900	9.7	50,150	5,830	13.2	54,430	4,280	8.6	64,600	10,170	18.7	70,970	6,370	9.9	78,300	7,330	10.3
NEW ENGLAND:																					
Maine	4,290	530	14.1	4,600	310	7.2	5,250	650	14.2	5,520	270	5.1	6,080	560	10.2	6,700	620	10.2	7,200	500	7.5
New Hampshire	1,220	40	3.4	1,380	160	13.1	1,610	230	16.7	1,720	110	6.8	1,900	180	10.5	2,150	250	13.2	2,370	220	10.2
Vermont	1,450	—80	—5.2	1,640	190	13.1	1,820	180	11.0	1,890	70	3.9	1,830	—60	—3.2	2,080	250	13.7	2,263	183	8.8
Massachusetts	9,490	990	11.7	10,520	1,030	10.9	11,380	860	8.2	13,610	2,230	19.6	15,300	1,690	12.4	16,530	1,230	8.1	18,620	2,090	12.7
Rhode Island	2,220	240	12.1	2,470	250	11.3	2,700	230	9.3	2,980	280	10.4	3,260	280	9.4	3,400	140	4.3	3,580	180	5.3
Connecticut	5,100	380	8.1	5,580	480	9.4	6,060	480	8.6	6,280	220	3.6	7,400	1,120	17.8	8,150	750	10.1	8,750	600	7.3
MIDDLE ATLANTIC:																					
New York	13,140	1,130	9.4	13,920	780	5.9	15,340	1,420	10.2	16,380	1,040	6.8	19,350	2,970	18.1	21,130	1,780	9.2	25,550	4,420	20.9
New Jersey	13,070	1,200	10.1	14,050	980	7.5	12,470	—1,580	—11.2	14,200	1,730	13.9	15,150	950	6.7	15,930	780	5.2	17,200	1,270	8.0
Pennsylvania	11,290	1,390	14.0	13,950	2,660	23.6	16,230	2,280	16.3	20,050	3,820	23.6	22,100	2,050	10.3	25,200	3,100	14.0	30,300	5,100	20.2
SOUTH ATLANTIC:																					
Delaware	300	60	25.0	310	10	3.3	420	110	33.5	420	0	0.0	440	20	4.8	480	40	9.1	630	150	31.3
Maryland	3,434	574	20.0	3,940	506	14.7	4,600	660	16.8	4,700	100	2.2	5,060	360	7.7	5,525	465	9.2	6,050	525	9.5
District of Columbia	940	70	8.1	1,040	100	10.6	1,090	50	4.8	1,290	200	18.4	1,390	100	7.8	1,514	124	8.9	2,000	486	32.1
Virginia	3,160	380	13.7	3,500	340	10.8	4,370	870	24.9	4,410	40	9.2	5,100	690	15.7	5,590	490	9.6	6,160	570	10.2
West Virginia	760	90	13.4	820	60	7.9	1,150	330	40.3	1,320	170	14.8	1,700	380	28.8	1,780	80	4.7	1,865	85	4.8
North Carolina	2,140	90	4.4	2,390	250	11.7	2,490	100	4.2	2,940	450	18.1	3,410	470	16.0	3,700	290	8.5	3,700	0	0.0
South Carolina	960	80	9.2	1,100	140	14.6	1,090	—10	—0.9	1,150	60	5.5	1,380	230	20.0	1,658	278	20.8	1,660	2	0.0
Georgia	2,280	190	9.1	2,660	380	16.7	2,660	0	0.0	2,830	170	6.4	3,390	560	19.8	3,750	360	10.6	3,760	10	0.0
Florida	1,460	110	9.7	1,590	130	8.9	1,690	100	6.3	1,820	130	7.7	1,960	140	7.7	2,070	110	5.6	2,250	180	8.7
EAST NORTH CENTRAL:																					
Ohio	16,560	1,460	9.7	17,930	1,370	8.3	19,850	1,920	10.7	20,130	280	14.1	23,400	3,270	16.2	25,050	1,650	7.1	27,350	2,300	9.2
Indiana	8,600	830	10.7	9,530	930	10.8	10,180	650	6.8	10,740	560	5.5	12,100	1,360	12.7	13,200	1,100	9.1	13,900	700	5.3
Illinois	22,240	1,220	5.8	25,070	2,830	12.7	27,600	2,530	10.2	29,930	2,330	8.5	35,600	5,670	19.0	39,200	3,600	10.1	42,600	3,400	8.7
Michigan	9,670	750	8.4	10,340	670	6.9	11,130	790	7.6	11,400	270	2.4	12,580	1,180	10.3	13,720	1,140	9.1	15,100	1,380	10.1
Wisconsin	9,930	110	11.2	10,460	530	5.3	10,690	230	2.2	10,690	0	0.0	11,500	810	7.6	12,520	1,020	8.9	15,020	2,500	20.0
WEST NORTH CENTRAL:																					
Minnesota	5,150	990	23.8	6,240	1,090	21.2	6,870	630	10.1	7,060	190	2.8	7,660	600	8.5	8,650	990	12.9	9,300	650	7.5
Iowa	5,970	100	17.1	6,460	490	8.2	6,880	420	6.5	6,930	50	7.3	7,300	370	5.3	7,410	110	1.5	7,630	220	3.0
Missouri	7,620	890	13.2	8,570	950	12.5	9,650	1,080	12.6	10,710	1,060	11.0	12,340	1,630	15.2	14,150	1,810	14.7	15,400	1,250	8.8
North Dakota	820	170	26.2	950	130	15.9	1,110	160	16.9	1,120	10	1.0	1,120	0	0.0	1,233	113	10.1	1,324	91	7.4
South Dakota	1,320	0	0.0	1,400	80	6.1	1,410	10	1.0	1,440	30	2.1	1,440	0	0.0	1,680	240	16.7	1,840	160	9.5
Nebraska	2,360	270	12.9	2,630	270	11.4	3,040	410	15.6	3,310	270	8.9	3,980	670	20.3	4,360	380	9.6	4,710	350	8.0
Kansas	2,900	330	12.8	3,270	370	12.8	3,680	410	12.5	4,080	400	10.9	4,710	630	15.4	4,950	240	5.1	5,370	420	8.5
EAST SOUTH CENTRAL:																					
Kentucky	1,930	110	6.1	2,160	230	11.9	2,380	220	10.2	2,520	140	5.9	3,060	540	21.4	3,275	215	7.0	3,580	305	9.3
Tennessee	2,490	280	12.7	2,740	250	10.1	2,910	170	6.2	3,090	180	6.2	3,490	400	12.9	3,810	320	9.2	4,040	230	6.0
Alabama	2,040	180	9.7	1,970	—70	—3.4	2,160	190	9.7	2,060	—100	—4.6	2,370	310	15.1	2,540	170	7.2	2,720	180	7.1
Mississippi	500	40	8.7	580	80	16.0	580	0	0.0	620	40	6.8	660	40	6.5	646	—14	—2.1	723	77	11.9
WEST SOUTH CENTRAL:																					
Arkansas	1,480	150	11.3	1,350	—130	—8.8	1,580	230	17.0	1,630	50	3.2	1,900	270	16.5	2,195	295	15.6	2,680	485	22.2
Louisiana	1,260	120	10.5	1,150	—110	—8.7	1,340	190	16.5	1,380	40	3.0	1,620	240	17.4	1,877	257	15.9	2,147	270	14.4
Oklahoma	3,680	310	9.2	4,060	380	10.3	4,310	250	6.2	4,840	530	12.3	6,390	1,550	35.7	7,300	910	14.3	7,760	460	6.3
Texas	3,210	900	39.0	4,090	880	27.4	5,110	1,020	24.9	5,930	820	16.1	7,440	1,510	25.5	8,820	1,380	18.6	9,950	1,130	12.8
MOUNTAIN:																					
Montana	1,330	80	6.4	1,420	90	6.8	1,440	20	1.4	1,870	430	29.9	2,000	130	7.0	2,172	172	8.6	2,240	68	3.1
Idaho	660	80	13.8	740	80	12.1	850	110	14.9	930	80	9.4	1,120	190	20.2	1,250	130	11.6	1,390	140	11.2
Wyoming	320	40	14.3	360	40	12.5	410	50	13.9	450	40	9.8	540	90	20.0	603	63	11.7	671	68	11.3
Colorado	3,800	250	7.1	4,070	270	7.1	4,270	200	4.9	4,480	210	4.9	4,520	40	8.9	5,000	480	11.6	5,800	800	16.0
New Mexico	290	0	0.0	270	—20	—6.9	330	60	22.2	270	—60	—18.2	250	—20	—7.4	193	—57	—22.8	215	22	11.4
Arizona	169	49	41.0	203	34	20.1	271	68	33.5	305	34	12.6	372	67	22.0	606	234	63.0	616	10	1.7
Utah	1,640	450	37.8	1,640	0	0.0	2,530	890	54.3	2,220	—310	—12.3	2,350	130	5.9	2,630	280	11.9	3,050	420	16.0
Nevada	330	0	0.0	310	—20	—6.1	290	—20	—6.5	230	—60	—20.7	250	20	8.7	250	0	0.0	250	0	0.0
PACIFIC:																					
Washington	6,240	970	18.4	7,180	940	15.1	7,000	—180	—2.5	7,300	300	4.3	7,680	380	5.2	8,180	500	6.5	8,700	520	6.4
Oregon	3,230	820	34.0	3,840	610	18.9	4,250	410	10.7	4,380	130	3.1	4,720	340	7.8	5,190	470	10.0	5,600	410	7.9
California	30,950	3,800	14.0	33,300	2,350	7.6	38,900	5,600	16.8	42,750	3,850	9.9	52,200	9,450	22.1	57,600	5,400	10.3	64,000	6,400	11.1

42,000 New Power Customers in 1921

Industrial Depression Failed to Halt Addition of New Consumers of This Class to Central-Station Lines—Customers Totaled 429,584 on Jan. 1, 1922

A LARGE amount of publicity has been given to the extensive domestic wiring campaigns which central distributing companies have conducted during the past year to acquire new load to take the place of the greatly curtailed industrial power load. It has often been made to appear that the acquisition of new industrial power customers during the industrial depression was practically out of the question and that the increase of residential load was the only resource. In some districts this has probably been a fact, but throughout the country as a whole strenuous work has been done during the past year by new-business departments to build up the industrial load as well as the domestic lighting load.



NUMBER OF NEW INDUSTRIAL POWER CUSTOMERS PER YEAR FROM 1915 TO 1921 INCLUSIVE

The extent to which the industrial power customer has been cultivated by the central electric distributing companies of the country is clearly indicated by a survey recently made by the *Electrical World*. In spite of the industrial depression from which the nation is just emerging, the number of industrial power customers was increased by 41,987 during 1921. During the same period 1,001,700 domestic lighting customers and 175,000 commercial lighting customers were also added to the service lines of the industry. About one and a quarter million customers were, therefore, added to the distributing systems of the country during a year of unprecedented business and industrial inactivity. Such a record is one of which the industry may well be proud.

There was a total of 429,584 industrial power customers on Jan. 1, 1922, an increase of 194,191 during the six-year period from Jan. 1, 1916. The greatest yearly growth took place in 1919, when 44,557 customers of this class were added to the service lines of the industry. While these various figures for power customers are only about 5 per cent of the total number of new residential customers added during the same periods, it must be remembered that one industrial power customer may consume several hundred times as much electrical energy as a single residential lighting customer.

As would be expected, the intensely industrial section of the country which comprises the five East North Central States easily leads in total number of industrial customers, the figure being 113,970. A recent survey indicates that this group of states also leads the country in the total number of domestic lighting customers. This section has a total of about 2,850,000 customers of all classes, or about 26 per cent of the total number in the whole country. The three Pacific Coast States, taken as a whole, are second with 78,300 industrial power customers.

California far outstrips any other state in the number of industrial power customers, with 64,000, or almost one-sixth of the total for the entire country. This state also added the most customers of this class to its lines during 1921. The predominance of California in industrial customers is due primarily to the extensive use of electrical energy for irrigation and other farming purposes. The transmission and distribution systems of the central stations of that great agricultural state cover practically every farming community. If electrical energy is not used by the farmer to run a private pumping plant, it is used in other ways to lighten the burden of farm duties. Moreover, California's manufacturing growth is recent as compared with that in the industrial states of the East, and it is but natural that as manufacturing in this state has advanced almost contemporaneously with the growth of the electrical industry it should become very highly electrified. In addition, the presence of large water powers within the state, and a consequent low cost of energy production, has enabled the central distributing companies to offer special inducements to consumers of bulk energy which can be duplicated in few of the older industrial states of the East.

Illinois is second in number of industrial power customers, with 42,600, and Pennsylvania is third, with 30,300 customers. New York, the leading manufacturing state of the Union, is fifth.

The results of a survey to ascertain the growth in residential lighting customers appeared in the Jan. 14, 1922, issue of the *Electrical World*. A similar tabulation is being made of the growth in number of commercial lighting customers and will appear in an early issue. These surveys are made every two years and are believed to represent very accurately conditions in the electric light and power industry.

Rural Electric Service Costs Analyzed

Costs of Service from the Power House to the Consumer Analyzed for Iowa Situation—Monthly Costs to Consumer Under Various Financing and Maintenance Arrangements

By W. J. GREENE
Iowa Railway & Light Company

IN AN effort to determine the real situation as to the cost of rendering rural electric service an extensive study of actual conditions existing on a part of the system of the Iowa Railway & Light Company has been made. In making the study it was felt that attention should be given to the entire costs from the power house to the consumer's meter and that the study should not be stated with the assumption of adequacy of the present urban rates, and rural rates be made by simply adding the excess cost of rural service to present urban rate schedules. If errors exist in any present urban rate, it was thought best to eliminate such errors from the rural rates before the rural business became extensive. We feel that our rural business should be developed on economic principles and that we have the opportunity to direct its growth on a sound business basis, profiting by our errors in the past. Although in many cases it will undoubtedly be easier for the sales department to start with present urban rates, and although from an educational standpoint that may be the best way, yet it is certain that eventually power-plant and transmission demand costs must be introduced accurately. Rural consumers represent a distinct class of service and the elements entering into the cost of that service should be determined without regard to the other classes of service. The figures in the following tables are based on average conditions as found, though careful consideration has been given to specific situations. Energy costs are taken at 3 cents per kilowatt-hour delivered to the consumer. All other costs are taken at the figures given in the tables. It is assumed that each consumer has a demand of 1 kw. and will be served by a 1½-kva., 6,600-volt transformer. Fifteen years is taken as the natural life of the rural equipment.

TABLE I—PRIMARY COST DATA IN RURAL SERVICE ANALYSIS

	Particulars		Costs per Consumer	
	Urban	Rural	Urban	Rura
Meters installed	$9.15	$10.40	$1.65	$2.08
Meter shunt losses, at 3 cents per kw.-hr.	.....	.....	.48	.48
Services, per consumer	6.83	25.00	1.23	5.00
Transformer capacity per consumer in volt-amperes	294	1,500	.....	.....
Average kva. transformer capacity	9.7	1.5	.....	.....
Consumers per transformer	33	1	.....	.....
Transformer investment per consumer installed	$4.80	$164.00	.86	32.80
Transformer core losses, at 3 cents per kw.-hr.	.....	.....	.57	7.20
Poles, fixtures and conductors per mile	$2,400.00	$900.00	.....	.....
Consumers per mile	54	2.5	.....	.....
Investment in poles, fixtures and conductors per consumer	$44.20	$360.00	7.96	72.00
Portion of city distribution	.....	.....	.....	.....
Commercial service expenses	.....	.....	3.15	3.15
Generation and transmission	.....	.....	14.40	14.40
Consumer element of general expenses	.....	.....	2.00	2.00
Total annual cost			$32.70	$143.07
Monthly cost	.....	.....	2.72	11.92
			Per Cent	Per Cent
Rate of return			8	8
Insurance			0.5	0 5
Taxes			1.5	1.5
Maintenance			3	5
Depreciation and retirement from all causes			5	5
Total investment rates			18	20

TABLE II—CITY DISTRIBUTION LINE COSTS INVOLVED IN RURAL SERVICE

	Total Investment per Consumer	Consumer Portion	Demand Portions
Poles and fixtures	$27.98	$13.99	13.99
Conductors	16.22	8.11	8.11
Total	$44.20	$22.10	$22.10

Monthly consumer investment expense = 0.18 × 22.10 ÷ 12 = 33 cents.

MEANING OF TABLES

The study of costs of the service to the farmer is based on the primary cost data given in Table I. In this table both urban and rural service costs are presented for comparative purposes. It will be noted that the value for commercial service expenses is made the same for urban and rural service. It is assumed that farmers will read meters and report on post cards, or meters will be read by the company not oftener than six times a year. Monthly bills will be rendered and collected either for an estimated consumption and demand and adjustments made when the meters are read, or the consumer portion, which will be more than 80 per cent of the charge, may be collected monthly and the balance every two or three months.

Table II gives the value of distribution lines within the corporate limits of adjoining cities or towns, from which is determined the amount chargeable to rural consumers for transmitting electricity to the corporate limits. Table III is a reduction of the fixed charges on certain investments to a monthly basis of cost. Table IV gives on a monthly basis certain items of costs from Tables I, II and III incurred by the utility and chargeable against the rural consumer under any arrangements for the construction and maintenance of the rural lines. Power-plant and transmission demand costs are included in the generation and transmission item of $1.20 in Table IV. Transmission lines are considered as an extension of power-plant busbars and therefore transmission costs are included with the power-plant demand costs. The value is based on a determination

TABLE III—FIXED COSTS ON CERTAIN INVESTMENTS IN RURAL ELECTRIC SERVICE

	Investment	Annual Investment Expenses	Monthly Investment Expenses	Monthly Investment Expenses Less Interest	Monthly Investment Expenses Less Interest and Depreciation
Service lines per consumer	$25.00	$5.00	$0.42	$0.25	$0.15
1½-kva., 6,600-volt transformer	164.00	32.80	2.73	1.64	.96
Pole-line per mile	900.00	180.00	15.00	9.00	5.25

of demand costs in a specific situation covering the determination of such costs for eight towns served from 65 miles of transmission lines, and it is felt to be representative, although variable for different situations.

Tables V, VI and VII give the costs to consumers for maintenance items on several bases and with different numbers of consumers per mile. Table V shows the probable cost to consumers for maintenance of line and transformers and public liability insurance where the consumer finances and maintains the lines himself or contracts with the utility for the maintenance. No investment cost is included because the lines are financed and owned by the consumer. Table VI shows the probable line and transformer costs to consumers where the lines are financed by the consumer but ownership and perpetual maintenance is assumed by the utility. Table VII shows the probable line and transformer costs to consumers where the utility finances, owns, operates and maintains the lines and transformers. The derivation of these tables can be traced from Table III, where the rural line and transformer investment expenses are presented on several bases.

TABLE IV—CERTAIN MONTHLY COSTS INVOLVED IN RURAL ELECTRIC SERVICE PER CONSUMER BASED ON 1 KW. DEMAND

Meters	$0.17
Meter shunt-coil losses	.04
Transformer core losses, 1½ kva., 6,600 volts	.60
Portion of city distribution line	.33
Generation and transmission	1.20
Commercial office	.26
Consumer element of general expense	.17
Total	$2.77

Taking these seven tables as a foundation, Tables VIII, IX, X and XI show the probable cost in cash to a consumer under the various methods of providing service. These costs are given on the basis of several numbers of consumers per mile from one to fifteen and for monthly consumptions of 0, 13, 20, 30 and 60 kw.-hr. In Table VIII is given the cost to consumers, excluding maintenance of line and transformers, public liability and investment costs of lines and transformers. Investment costs are insurance, taxes, depreciation and money costs. In Table IX are given the probable expenses in cash for each month of the first fifteen years for consumer ownership of the lines. At the end of the fifteen years the farmer will begin to be confronted with a replacement of the lines and transformers. The make-up of the figures is illustrated by attention to the first figure, $9.48, in the column headed 0 kw.-hr. The item is made up of $6.71 from first column, Table V, giving the cost of maintenance and insurance and the item of $2.77 from Table IV, which is the utility service cost exclusive of any energy sold. The item of $9.87 at the head of the following column is made up of the $9.48 item plus the energy cost of 13 kw.-hr. at 3 cents. No provision is made for interest and depreciation or the creation of a reserve for the replacement of the property, since the consumer assumes this burden. The data in Table X are based on the assumption that the consumers finance the lines and transformer and the utility accepts ownership and perpetual obligation of maintenance. The values are obtained from Tables IV and VI, with the energy costs at 3 cents added. Table XI shows the payments by the consumer on a monthly basis where the utility takes the entire responsibility of financing, operating and maintenance of the lines and transformers just as is done with urban consumers. The values are obtained from Tables IV and VII with energy costs added as in the case of the two preceding tables.

TABLE V—PROBABLE AVERAGE COST FOR MAINTENANCE OF LINES AND TRANSFORMERS, AND PUBLIC LIABILITY INSURANCE

	Costs per Consumer per Month					
Consumers per Mile	1	2½	3	5	10	15
Service lines	$0.15	$0.15	$0.15	$0.15	$0.15	$0.15
Transformer	.96	.96	.96	.96	.96	.96
Pole line	5.25	2.10	1.75	1.05	.53	.35
Public liability	.35	.35	.35	.35	.35	.35
Total	$6.71	$3.56	$3.21	$2.51	$1.99	$1.81

TABLE VI—LINES AND TRANSFORMERS FINANCED BY THE CONSUMER AND MAINTAINED BY THE UTILITY

This table shows the cost to the consumer of the utility expenditures involved in upkeep of the property.

	Costs per Consumer per Month					
Consumers per mile	1	2½	3	5	10	15
Service lines	$0.25	$0.25	$0.25	$0.25	$0.25	$0.25
Transformer	1.64	1.64	1.64	1.64	1.64	1.64
Pole line	9.00	3.60	3.00	1.80	.90	.60
Total	$10.89	$5.49	$4.89	$3.69	$2.79	$2.49

The data in Table XI indicate a monthly cost for all items without any energy from $6.92 per month per consumer for fifteen consumers per mile to $20.92 for one consumer per mile. In other words, this group of figures represents the total fixed and operating charges incurred in establishing and maintaining the service from the power house to the consumer without any allowance for general expenses, contingencies and profit to the utility except the very small amount represented by the difference between 8 per cent and the actual money cost rate applied to the investments in property required for rendering the service. No allowance is made for contingencies and profit on the energy cost in the items where energy costs are included. The same is true of Tables IX and X, the only difference in them being that the farm customer carries certain items of cost by making investments himself and assuming cost of maintenance and liability, and consequently makes smaller cash payments per month. In the final analysis the consumer actually incurs the total costs shown in Table XI just as fully where the lines and transformers are financed, owned and maintained by the consumers as where they are the property of the utility, even though all the cost is not reflected in the monthly cash payments.

TABLE VII—LINES AND TRANSFORMERS FINANCED, OWNED, MAINTAINED AND OPERATED BY THE UTILITY

	Cost per Consumer per Month					
Consumers per mile	1	2½	3	5	10	15
Service line	$0.42	$0.42	$0.42	$0.42	$0.42	$0.42
Transformer	2.73	2.73	2.73	2.73	2.73	2.73
Pole line	15.00	6.00	5.00	3.00	1.50	1.00
Total	$18.15	$9.15	$8.15	$6.15	$4.65	$4.15

Another interesting part of the study is shown in Table XII. In this the percentage of energy costs to the total costs of service are shown. In the case of the rural consumer who uses 30 kw.-hr. per month and is served from a line with three or fewer consumers per mile, the energy costs are less than 8 per cent of

TABLE VIII—CONSUMER OWNS AND MAINTAINS HIS OWN LINES AND EQUIPMENT

	Cost per Consumer per Month				
Kilowatt-hours per month	0	13	20	30	60
Cost basis	$2.77	$3.16	$3.37	$3.67	$4.57

TABLE IX—CONSUM R OWNS AND MAINTAINS HIS OWN LINES AND EQUIPMENT

Kilowatt-hours	Cost per Consumer per Month 0	13	20	30	60
Consumers per mile:					
One	$9.48	$9.87	$10.08	$10.38	$11.28
Two and one-half	6.33	6.72	6.93	7.23	8.13
Three	5.98	6.37	6.58	6.88	7.78
Five	5.28	5.67	5.88	6.18	7.08
Ten	4.76	5.15	5.36	6.66	6.56
Fifteen	4.58	4.97	5.18	5.48	6.38

the total costs, whereas with the average city residence consumer taking 13 kw.-hr. such costs are 18 per cent. The load factors given in the table are those for a consumer with 1 kw. demand and the various consumptions indicated.

The most significant figures are those in Table XI because they represent the total costs of service regardless of what plan of giving service is adopted. For one consumer per mile the yearly revenue required to render the service without the use of any electricity is $251 per mile of line per year. With three consumers per mile the yearly revenue without the use of any electricity is $393 per mile, or $131 per customer per year. If rates are made in the same manner as the values are presented, a very low energy rate would be had, so that the cost for even large amounts of electricity would be small as compared with the fixed costs.

If rates are to be based purely on the kilowatt-hours used, economical methods for a large use of electricity on the farm must be developed. The rural consumer would have to guarantee a large use of electricity before the utility would be insured of a return sufficient to cover costs. Even at three consumers per mile and a consumption of 100 kw.-hr. per month per consumer, which would be a heavy consumption for a rural consumer with no device installed taking more than 1 kw., the rate per kilowatt-hour would be fully 11 cents. If the consumption were 30 kw.-hr. per month, the rate would be fully 29 cents per kilowatt-hour. With demands over 1 kw. the cost of the extra demand must be considered.

It is not intended that the values given in this study are to be accepted for other situations, nor is it intended to advocate any form of rate by the "set-up" of the figures. The intention is to present such a set-up as will give an accurate vision of costs and forms that any one may use. If values applying to any utility's specific situation are substituted in the forms, the utility cannot only arrive at the true costs covering its situation and ascertain what minimum amounts of revenue must be provided to cover all items of cost from the consumers' meters back to the power house, but it will have the necessary data upon which to build rates.

The four main problems involved in the rural business are:

1. The rate under which utilities can undertake the business with lines and transformers financed, owned and operated by the utilities.

2. The economic value of the service to the farmer —that is, the value of the labor saved and the increased output of the farm business.

3. The better living value of the service to the farmers—that is, the greater value of electricity for home lighting and other house uses over other methods.

4. How to insure the utility of adequate revenue for a period of at least fifteen years in those cases where the economic value of the service is less than the cost of the service, or the farmer fails to utilize the service to its full economic value, or the farmer cannot afford to pay the excess cost over other methods of the better-living value.

From such information as has been collected it is evident that the economic value of the service to a large number of farmers will be many times the cost, and that very few cases will be found where the economic value will not exceed the costs, provided the farmer utilizes the electric service to its full extent. If such should prove to be the fact, most rural consumers would be enabled to take advantage of the better-living value without any extra cost, and the stability of the business would be assured.

Utility operators generally agree that utilities should, in theory, finance, maintain and operate the rural lines and transformers and incorporate the costs in rates, just as is done in cities. Some operators realize that it is up to the utility to prepare rates and contracts on this basis and be prepared to offer them to the farmers.

TABLE X — CONSUMER FINANCES LINE BUT GIVES OWNERSHIP TO UTILITY WHICH ACCEPTS RESPONSIBILITY FOR MAINTENANCE, OPERATION AND RECONSTRUCTION

Kilowatt-hours	Cost per Consumer per Month 0	13	20	30	60
Consumers per mile:					
One	$13.66	$14.05	$14.26	$14.56	$15.46
Two and one-half	8.26	8.65	8.85	9.16	10.06
Three	7.66	8.05	8.26	8.56	9.46
Five	6.46	6.85	7.06	7.36	8.26
Ten	5.56	5.95	6.16	6.46	7.36
Fifteen	5.26	5.65	5.86	6.16	7.06

TABLE XI—UTILITY FINANCES, OWNS, MAINTAINS AND OPERATES AS IN THE ORDINARY CASE OF URBAN SERVICE

Kilowatt-hours	Cost per Consumer per Month 0	13	20	30	60
Consumers per mile:					
One	$20.92	$21.31	$21.52	$21.82	$22.72
Two and one-half	11.92	12.31	12.52	12.82	13.72
Three	10.92	11.31	11.52	11.82	12.72
Five	8.92	9.31	9.82	9.82	10.72
Ten	7.42	7.81	8.02	8.32	9.27
Fifteen	6.92	7.31	7.52	7.82	8.77

TABLE XII—RATIOS OF ENERGY COSTS TO TOTAL COSTS GIVEN IN TABLE IX, AND LOAD FACTORS

Kilowatt-hours	Percentage of Cost per Consumer per Month 13	20	30	60
Consumers per mile:				
One	1.83	2.78	4.12	7.92
Two and one-half	3.17	4.79	7.02	13.12
Three	3.45	5.21	7.61	14.15
Five	4.19	6.30	9.16	16.79
Ten	4.99	7.48	10.82	19.52
Fifteen	5.33	7.98	11.51	20.64
Urban customers	18.5	22.6	30.4	46.7
Load factors, per cent	1.80	2.70	4.10	8.20

It would be of great economic value for all utilities to use the same form of rates and contracts, although rates will naturally vary in different places; and the National Electric Light Association might encourage the adoption of uniform forms and contracts by having forms prepared which it can recommend for use by its members.

Believing that utilities should take the lead in bringing together representatives of the utilities, the practical farmers, the various farm organizations, the agricultural colleges and the farm press for the purpose of making a careful study of the conditions and determining the economic value of the service, the better living value of service, and to what extent the rural consumers can guarantee continuity of service for a long enough period to warrant utilities in financing the lines and transformers, some operators have started efforts that should result in practical results along these lines.

A Word to Utility Stock Salesmen

Being a Little Sermon on the Salesman and Wherein He Differs from the Solicitor in Appearance, Speech, Judgment, Knowledge, Enthusiasm, Cheerfulness and His Worth in the World

By WARREN R. VOORHIS
American Water Works & Electric Company, New York

A SOLICITOR is a person who asks other people to buy goods.

A salesman is one who sells goods.

Solicitors are as the sands of the sea for numbers, and landlords put up signs against their intrusion.

But they who have articles for sale will scour the seven seas on the bare chance of finding a salesman.

For the visit of a solicitor is sore affliction.

But a salesman is as welcome as a breath of spring at the end of a hard winter.

When a solicitor calls upon me with an article which I do not want, a wave of the hand, or, at the very worst, the jog of an elbow, will dispose of the matter.

When a solicitor calls upon me with an article which I have sometimes thought I wanted, the encounter takes more time, but, by bringing up reserves, I usually rout him.

But on the day when I am lucky enough to receive a salesman, all my defences crumble even before we have finished our consideration of the weather; I am as clay in the hand of the potter, yea, even as green grass before the sickle.

I can remember every salesman who ever operated on me, but I have forgotten what it was he sold me.

So I conclude that in salesmanship the salesman is a factor.

I imagine that a salesman first sells himself and then his goods.

The Salesman's Appearance

Now, then, I will write about these salesmen who have come, seen and conquered me, so that knowledge of their ways and habits may be more generally known.

A salesman, being about to sell himself, takes thought about his appearance.

No personal property ever pays higher dividends to the salesman than a clothesbrush, a shoebrush and a safety razor.

In these days ready-to-wear clothing is as good as any—as the magazine pictures testify—and apparel of moderate price is better than expensive display. Indeed, I should think a public utility stock salesman, expecting to find his customers among sober, thrifty people, would do well to dress soberly and quietly, but with cleanness and neatness everywhere apparent.

Long hair is a profession in itself and amateurs should not attempt it. Be fair to the barber.

Remember that a white collar is right out on the firing line; in the area of very high visibility it can stand a limited amount of exposure only. When you consider your collar in the gray morning light, resolve all doubts in favor of a fresh one.

I have heard that when a salesman is clean and trim and well brushed and well turned out generally this has its effect on the salesman, giving him assurance, confidence and self-respect and makes him more dangerous and deadly in attack.

I know nothing of this, for I consider a salesman from the viewpoint of the buyer.

When a man who has evidently taken thought of his personal appearance calls on me I am complimented and at once straighten my own tie and try to polish my shoe on my trouser leg.

A salesman seems to think it helpful to make a good impression to begin with. I suppose this is the reason that he is careful about his appearance.

The Salesman's Speech

I have noticed that a salesman is rather careful to use good, plain, serviceable language. He appears to have no rooted dislike for the common rules of grammar.

He avoids extravagant and irresponsible statements. There is a world of difference between a slick-tongued solicitor and an enthusiastic salesman.

A salesman believes that the slang of the street belongs in the street and that it is not an essential part of a business interview.

I have had solicitors swear a little and tell me a story in order to put me at ease and to make me feel that we were both perfectly at home.

A salesman seems to assume that his interview with me is in the nature of a business engagement and that his time has some value. A very high-grade salesman will even assume that my time is of some possible value to me.

I would not think of advising which is the better way.

I recall, though, that I have been frequently entertained by solicitors—but the salesman got my money.

I should think that a public utility stock salesman whose business it is to induce people to save their money and to invest it wisely would do well to cultivate the habit of using plain, direct speech.

The Salesman Chooses the Occasion

Salesmen have always taken an unfair advantage of me. If I could encounter a salesman before I have had a cup of coffee in the morning, or on the day I pay my taxes, or when I have just lost a lawsuit, or when I have a cold in my head, I believe I would have a sporting chance against even the best of them.

But a salesman awaits occasions; nay, more, and worse, a salesman makes occasions.

He seems to think that a good appearance, good language and address is all lost on a poor opportunity.

All times and seasons are alike to the solicitor. He regards neither time, place nor circumstance. Solicitors rush in where salesmen fear to tread.

A salesman awaits that rare combination—the man, the hour and the place—but not long. If nothing happens, he makes it happen.

All salesmen must read and believe that saying of

Napoleon that he won battles because he always chose the time and the place.

I reject the theory that salesmen are always cheerful and smiling and happy people—although I never saw one any other way. Upon reflection I am of opinion that when a salesman is blue or downcast, or has any kind of a misery, he simply holes up and waits for his sky to clear.

I believe if I could meet a salesman when he is down in the mouth I could win out against him, but I have never had the opportunity.

A salesman seems to consider his friendly smile, his air of genuine, hearty, prosperous good feeling an important element of a business transaction.

All my life it has been hard for me to dislike or resist cheerful, friendly, hearty people. Lots of men are that way.

A salesman braces me up. He makes me wonder whether it would pay *me* to smile and be happy in *my* business.

The Salesman Has Opinions

Solicitors and salesmen are both invariably courteous to me. It would be most discourteous of me to assert the contrary.

For instance, a solicitor always agrees with me. I have yet to meet a solicitor whose views on religion, politics, morals or the weather did not agree precisely with my own.

This is either a remarkable coincidence or else these solicitors have believed that I would be angered and repelled by their slightest expression of independent or original thought.

I state it as a fact that salesmen undoubtedly have views about general topics, for in my own office many times I have held conversation with salesmen and taken much profit therefrom.

I think it very likely that salesmen read newspapers and books and observe a good deal for the very purpose of being generally alert and well informed.

I am afraid there is a disposition to look down on a solicitor, but you try hard to live up to a salesman.

Of all men I believe solicitors have the best memories.

Somebody must teach solicitors all that they shall say and do from the "Good morning, Mr. Jones," to "Good afternoon" or "Good night," depending on the length of the engagement.

They recite beautifully, and I love to hear it, for it always takes me back to my boyhood, when I used to render "The Wreck of the Hesperus" on Friday afternoon at school.

It is really quite an effort to memorize an hour's talk and say it without leaving out a comma, or hardly stopping to take breath, and I always try to be careful not to ask any question or say anything to a solicitor which might throw him off the track.

The Salesman Knows His Subject

But there is one thing I do know for certain and here bear testimony:

A salesman really does know all he can find out about his subject, whether it is brooms or bonds.

In my earlier years, hoping to confound the salesmen, I have at times asked questions. I thought more highly of myself than I should, for a salesman merely uses a question as a text for a new and stronger argument. A salesman welcomes an interruption.

I am sure that a public utilities stock salesman will find it useful to know all about the general subject of public utilities.

He will want to know how they serve the public. He will be interested in the fact that public utilities are managed, regulated and controlled under close public supervision.

He will want some knowledge of the vast and vital part which the public utilities have in our modern civilization.

Nor will he be content with a superficial knowledge of the character of the securities he offers. He will want to know all about the financing of public utilities as a modern business problem.

He will be interested and will interest other people in the fact that public utilities do not have periods of sharp expansion and depression in earnings, but that they earn moderately yet steadily.

The salesman of stock securities will never fail to keep in mind that his business is with people who are vitally concerned in the safe investment of their money. He is not selling articles of trifling value for immediate consumption, but he is endeavoring to interest people in that most vital of all subjects—the investment of hard-earned money.

The Salesman Has Enthusiasm

I have mentioned some of the characteristics of the salesmen I have known, but so far I have omitted perhaps the most important. Of course I mean enthusiasm.

I am always attracted by the appearance, speech, tact and knowledge of a real salesman, but I believe that it has been the enthusiasm of the salesman which has convinced and captured me.

I wish I could define enthusiasm. It seems to be some strong, inward, mental force which gives life, fire and vigor to all other qualities. It is imagination; it is personality. It does not seem to come out of books, nor is it taught in the schools. It is easier to describe its absence than its presence.

After a salesman leaves me I usually permit myself a few moments for reflection. I consider that nearly everything of good that has come to this world has arrived as a result of salesmanship.

It has been the knowledge, power, energy and enthusiasm—always the enthusiasm—of the salesman that has forced the world to adopt new courses for its improvement.

Three Great Salesmen

William Pitt was a great salesman; he sold the idea of the British Empire to Little England. And Benjamin Franklin was a very great salesman indeed; he sold the idea of a successful American commonwealth to France at a time when its success could not be seen except by its closest friends. Daniel Webster was a remarkable salesman who devoted his whole life and genius to the delivery to this country of one idea—its unity and indivisibility.

This is all I set out to say about salesmen and salesmanship.

Except that I want salesmen to keep on coming to see me.

When the time comes that a salesman can no longer interest me, instruct, fill me with enthusiasm and sell me, I will know that I am, in fact, stone dead, even though continuing to walk abroad as one in life.

Steel Engineers Desire Standardization

The Association of Iron and Steel Electrical Engineers at Their Annual Convention Discuss Anti-Friction Bearing, Control Standardization and Economy in Power Production

STANDARDIZATION and development were the keynotes in the convention of the Association of Iron and Steel Electrical Engineers held at Cleveland on Sept. 11-15. More than 900 engineers and manufacturers connected with the steel industry met, as reported in last week's issue, threshed out many common problems and renewed acquaintanceship.

This association has developed very rapidly and has gained recognition as one of the most active organizations in the country, and the tremendous power and bulk of the steel industry affords every incentive for the manufacturers to co-operate in its work.

Not the least impressive part of the convention was the exhibit display. The ground floor of the mammoth Public Hall of Cleveland was covered with booths representing more than ninety manufacturers of equipment used in steel mills, and their splendid displays created a great deal of interest among the attending engineers.

One of the most interesting sessions occurred Monday afternoon, when the committee reports were presented. They created lively discussion.

MOTORS TO BE STANDARDIZED

Motor standardization and anti-friction bearings were the chief subjects considered by the sub-committee on motors, D. M. Petty, chairman. Since no definite co-operation could be secured from the manufacturers in motor standardization, it was recommended that the matter be taken up with the Power Club. To ascertain the cause of breakdown of motors the committee sent a questionnaire to hundreds of engineers with the results tabulated below:

	Per Cent of Total Failures	
Cause of Breakdown	A.C. Motors	D.C. Motors
Burn-outs due to overheating	8	6
Breakdown due to insulation failure caused by:		
Oil	37	41
Moisture	5	15
Outside influence	34	17
Breakdown due to mechanical failure	16	21
Total	100	100

Many plants reported that 75 to 95 per cent of the mechanical failures could be eliminated by using ball or roller bearings and a proper lubricant. With this object in view the committee asked the manufacturers to develop anti-friction bearings that are interchangeable for all makes of motors.

There are many obstacles to the attainment of standardization in the outside casing dimensions of mill-type motors, said D. M. Petty in discussing the report, but such a step must be taken. He expressed a willingness to use all types of ball-bearing and roller-bearing motors but desired to secure co-operative action among the manufacturers first through the Power Club, so that the economy resulting from standardization could be obtained. E. S. Jefferies urged that standardization be attacked from the user's viewpoint. When standards are adopted they should be enforced. R. B. Gerhardt considered anti-friction bearings a good starting point in motor standardization. W. B. McMasters declared that the Wheeling Mould & Foundry has thirty ball-bearing motors in successful use. George Schaeffer pointed out that his company has been greatly inconvenienced because of dimensional changes in motor bedplates. He expressed the belief that 50 per cent of the breakdowns on alternating-current motors are due to oil getting in the windings and that anti-friction bearings would stop such action.

D. B. Rushmore agreed that the manufacturers should and would co-operate in giving the steel engineers what they desired, but pointed out the tendency to eliminate competition when standardization was carried to the extreme. J. M. Hipple of the Westinghouse company said it was the desire of the manufacturers to supply the consumers with what they desired and needed, but that standardization comes as a result of good practice and not of experimental developments. He questioned whether practice had proved the anti-friction bearing to be the best. He also pointed to the large number of installations already in operation where equipment would have to be replaced.

F. Hess of the Youngstown Sheet & Tube Company asserted that four years ago his company had made a specification on roller bearings to fit all motor frames and that his experience with them had been very satisfactory. Twenty per cent of motor troubles had been eliminated by their use, and the cost in lots of ten for a motor of the Crocker-Wheeler EW type was $65. He thought manufacturers would soon find it necessary to use roller bearings on all heavy-duty motors.

Eleven men reported satisfactory experience with roller or ball bearings, and one man reported unsatisfactory experience. The meeting voted to appoint a committee to co-operate with a committee from the Power Club in an attempt to secure standardization of mill-type motors and to work on the question of anti-friction bearings.

DEVELOPMENTS IN 1922

The past year in the steel industry has been marked chiefly by a recovery from the after-war slump, and no very marked electrical developments have occurred, according to R. B. Gerhardt, chairman of the electrical development committee. Of the new electrical developments the double-range Scherbius speed-regulating sets of the Lackawanna Steel Company and the Illinois Steel Company are particularly interesting. Several mills of the continuous type utilize individual motors for the separate stands, and there is a tendency to use direct current supplied from motor-generator sets or rotary converters in preference to several auxiliary schemes for obtaining adjustable speed.

The new rod-mill drive with control to insure fixed relative speeds and the new main-mill drive using slip-ring induction motors with frequency-changer sets for recovering the slip energy were the two most original developments, Mr. Gerhardt said. The use of the brush-

shifting adjustable-speed alternating-current motor is increasing to a greater degree.

The single-cell type of oil breaker is gaining in favor, and the increasing use of the Peterson coil and oxide-film arrester indicates that they are advantageous. Temperature indicators and other auxiliaries on transformers have helped obtain more reliable operation.

Electric heaters and yard electrification are new problems which have great possibilities and about which more data will soon be available. A new ring-filament lamp has been developed which is especially serviceable for portable lamps.

Internal-Combustion Engines for Mills

Gas and oil engines have economic justification in steel mills, said D. M. Petty in presenting his paper entitled "Internal-Combustion Engines for Power Generation in Steel Plants." In support of this statement he submitted data showing a net operating cost of $0.00246 per kilowatt-hour for a gas-engine power plant made up of six 3,000-kw. units and one 4,000-kw. unit and a fuel cost of $0.004018 per kilowatt-hour for a Diesel-engine plant. Consequently these prime movers should receive serious consideration for standby power or as peak-load absorbers, he declared.

W. M. Hampton of the Illinois Steel Company asserted that reliability and service are the predominating factors in steel-mill power supply. The Gary plant operates both steam and gas-engine units, there being fifty-six of the latter, with a total rating of 104,000 kw. The gas-engine units carry the base load and the turbines take the fluctuations. One of the gas engines can be started from a cold state and be put on the line in one and one-half minutes. Fifteen years' experience with them has proved them very satisfactory.

Frank Egan, in a written discussion, pointed out that the tables in the paper for gas-engine operating costs were based on coal at $2.50 and an installation charge of $162 per kilowatt, while the steam plant used coal at $7.50. He showed figures indicating equal operating charges for steam and gas-engine plants, but with a much lower fixed charge on a steam-turbine plant. The space requirement of 1 kw. per square foot for gas-engine installations compares unfavorably with 5 kw. to 5.5 kw. per square foot for turbine installations, he pointed out.

R. B. Gerhardt favored using both steam and gas units. E. Pragst declared the total cost of energy is the deciding element. W. I. Schneider laid stress on the importance of securing a good operating organization for either type of installation. Other members in discussing the papers favored a judicious combination of steam and gas units, depending on local conditions, and the majority opinion was to the effect that general conclusions as to relative merits are unsafe when based on a particular installation.

Trends in Boiler Development

A group of papers on the practice and tendencies in the use of boilers were presented by J. B. Crane, R. E. Butler, R. M. Rush and by E. R. Fish and Alfred Cotton. These gentlement talked largely from the experiences of their respective boiler companies, but agreed that large high-pressure boilers have come to stay. The items on which differences of opinion were expressed were size, pressure, combustion chamber and economizers. J. B. Crane pointed out that large boilers are not cheaper per horsepower than small ones, although a saving in floor space, building volume, amount of piping, valves, instruments, etc., is gained through their use. He declared that the Ladd Company is ready to build 9,000-hp. boilers (normal rating) capable of operating at 300 to 400 per cent rating. Whether to use high pressure and low superheat or low pressure and high superheat was a question which had warm advocates on each side; the limiting factor seems to be the requirement of the turbines to operate on steam under 700 deg. F.

Economizers of the cast-steel type are useful auxiliaries in modern boiler practice, declared R. E. Butler, when built with oxygen filters and for low velocity of water through the tubes. He pointed out that more heating surface is required when burning blast-furnace or metallurgical-furnace gases than is used in coal-fired applications, because high gas velocities are necessary to insure good heat absorption. R. M. Rush alluded to the advantages of the sectional header boiler with straight and bent tubes, saying that the cross-drum, straight-tube type is used in the majority of large central stations. Messrs. Fish and Cotton discussed baffling as applied to the Heine boiler and called attention to the advantages of horizontal baffling and the new bent-tube type of boiler which resembles the Stirling arrangement. This boiler, according to them, utilizes more radiant heat, assures better circulation and divides the gas flow.

Generating Station Progress

The subject of generating-station development was covered by D. B. Rushmore and E. Pragst with a breadth and perspective that are admirable. The advance in generating-station design, which has been largely the result of the development of equipment, according to the authors, was shown graphically by charts and curves indicating the changes in efficiency, size, water rate and transmission voltages for all types of generating-station apparatus. They also dealt with Diesel engines, the burning of blast-furnace gases and the use of powdered coal and showed the relative fields of the central-station and the isolated plant in steel-mill applications.

With regard to the future the authors predicted an increasing use of power, an increase in the price of present fuels, an improvement in the efficiency and cost of apparatus, the development of new fuels and high-speed rotating apparatus to utilize the fuels directly. If the atomic energy of coal could be released, Mr. Rushmore said, one pound would supply Schenectady for eight years, where 300,000 tons are consumed per year with existing methods of fuel utilization.

F. D. Newbury, in a written discussion, pointed out the changes in design and also showed the possibility of the multiple-unit turbo-generator, particularly for base-load plants. Mr. Stoltz of the Westinghouse company stated that a steel-mill power plant should operate on 20,000 to 21,000 B.t.u. per boiler.

Mr. Crane referred to the objections of insurance people to welded boilers because even riveted boilers sometimes failed near the joints. More study is needed of metal molecular structure before they will accept welded boilers. The Ford boilers at River Rouge, which have been burning powdered coal, gas, blast-furnace gas, tar and oil, have operated satisfactorily on all the fuels, the speaker declared.

Mr. Rushmore closed the discussion by explaining different ways of obtaining a heat balance and pointing

out that the small clearances and overhung blades made it difficult to construct large Lungstrom turbines. He also stated that standard designs in this country give better economies. He thought welded boilers would be used in the future and that a method for testing welds was needed most.

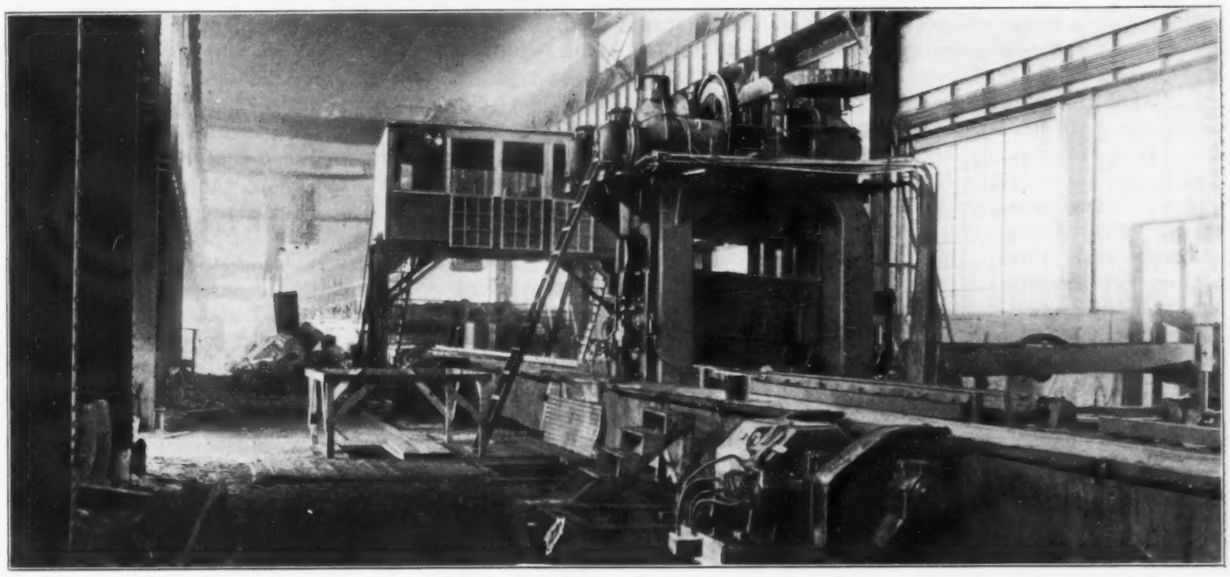
Electrification of the Huntington (W. Va.) plant of the International Nickel Company was discussed in a paper presented by F. C. Watson. This new plant embodies some of the latest practices in wiring, motoring and lighting. Safety-truck-type switchboards are used in the control room, and every precaution is taken to insure safe and automatic control of all electrical equipment.

Two new features were incorporated in the plant. The first is a Westinghouse adjustable-speed wound-rotor induction-motor set with auxiliary motors whereby the slip frequency is utilized to make useful the slip energy which has heretofore been wasted in rotor resistance. The second is a sectional drive installation on a rod mill whereby each section has a fixed relative speed and yet the whole unit may have adjustable speed control.

The detailed treatment and specific tabulation of equipment will make Mr. Watson's paper very useful to other engineers. Ball-bearing motors are used in many applications, and in virtually all cases motors are used which have been designed to enable repairs to be made readily.

G. E. Stoltz stated that 2,300-volt distribution is used in the International Nickel Company's plant because of the compact arrangement of buildings. Overhead construction on steel towers is used in preference to underground cable because of the damp character of the soil. In answer to James Farrington, who questioned the use of two transformer banks, Mr. Watson explained that the main load is carried on a bank of three units and that another bank of two transformers in open delta is held as reserve. Mr. Watson also pointed out that the maximum transmission distance is about 1,000 ft. About 500 RLM dome reflectors are used in the mills, staggered at 50-ft. intervals, and all lighting is supplied by independent circuits from the substation. O. Needham suggested that accurate records be kept on the operation of the ball-bearing motors installed in different parts of this plant.

No changes of importance have occurred in steam-turbine operation, according to L. W. Heller, who presented a paper on the subject. He showed, in tabulated form, the performance of a cross-compound 40,000-kw. turbo-generator placed in operation in 1917 and then considered the new Colfax station, showing that the operating production was 8,000 kw.-hr. per man-hour with one unit and 9,000 kw.-hr. to 12,000 kw.-hr. per man-hour with two units. The operating organization for the main units and auxiliaries was presented. Considering the operation of Brunot Island station, the speaker pointed out that condensers have developed an average heat transfer of 250 B.t.u. per square foot per hour, during the past seven years, with 75-deg. (F.) water at the condenser outlet and a velocity of 5 ft. per second. Oil for lubrication, auxiliaries and changes in practice were also treated by the author in some detail.



EFFICIENCY, FLEXIBILITY OF OPERATION AND EASE OF DETERMINING PRODUCTION EXPENSES ARE INHERENT ADVANTAGES OF ELECTRIC DRIVE IN STEEL MILLS

An extremely valuable portion of the paper was based on the operating practice and record system of the Duquesne Light Company.

STANDARDIZATION OF CONTROL

Opinions regarding the advisability of standardizing the rating of contactors, resistance boxes, coils, resistance tubes and terminal boards were presented by the control committee, F. W. Cramer, chairman. A great diversity of opinion and practice was indicated but, at least, a start has been made to secure results. The committee expressed itself in favor of standardization and recommended co-operation with the Power Club to secure definite action.

Mr. Albrecht, a member of the committee, pointed out that no reasonable basis for rating had been found. Three ratings now exist—continuous, arc-rupturing capacity and motor horsepower. The committee has prepared a data sheet, he announced, which is to be submitted to manufacturers to enable users to compare ratings. The information that should be furnished the customer before the actual installation was outlined so that time might be saved in assembling material and

allotting space. He also pointed out that the committee had not agreed concerning the apparatus or devices which should be standardized. The Power Club has standard wiring-diagram symbols, but they are not followed by the manufacturers.

Gordon Fox agreed that standardization should be required and that the design of control apparatus should be improved, but said that no unanimity of opinion existed on various points. He advocated a piecemeal program.

H. E. Pierce suggested standardizing application and methods of control but not equipment. However, Mr. Petty and Mr. Fox thought this impossible even in a given plant. The question of standardization of control was referred to a sub-committee to work with a similar committee of the Power Club.

R. S. Shoemaker reported for the sub-committee on cranes, and the sentiment seemed to be that the crane specifications adopted last year were satisfactory.

MILL LIGHTING

Mill lighting was a subject on which much attention was concentrated during the year by the sub-committee on illumination, R. G. Bauer chairman. Investigation showed that the incandescent lamp is now almost universally used, the RLM dome is gaining in favor, and safety requirements are being followed more closely. Laws based on the Illuminating Engineering Society's factory-lighting code have been put into effect in Pennsylvania, New Jersey, New York, Wisconsin, Oregon, California and Ohio. The committee advocated the keeping of accurate records of replacements and renewals since they facilitate the detection of conditions that should be changed.

GAS ANALYSES PREDETERMINE EFFICIENCY

An elaborate discussion of the importance of making gas analyses to predetermine the combustion performance, telling how to make the tests and how to interpret them, was the chief substance of a paper by A. G. Witting. He considered blast-furnace gas, coke-oven gas and producer gas and developed formulas for determining the efficiency of combustion using these gases.

In discussing the paper of Mr. Witting nearly every member brought out the fact that the field of gas analysis is very important and relatively unexplored. They agreed that radiation is a large but unknown factor in gas efficiency and that existing analyses when used in efficiency calculations may lead to incorrect conclusions regarding gas-fired boiler efficiency. It is essential to know the luminosity of gas as well as the B.t.u. content in determining the desirability of gas for combustion purposes, it was asserted.

INSULATORS INVESTIGATED

The work which has been done to investigate insulators for steel-mill service was outlined by the sub-committee on transmission, A. R. Leavitt chairman. It was reported that deposits of dirt on insulation give the greatest trouble by allowing leakage; however, test data were given proving that the kind of dirt has little effect. The arc-over voltage is the limiting factor in steel-mill service, but the self-cleaning type is of questionable value owing to the low dielectric field intensities involved. More definite data and reports were urged by the committee.

Mr. Walberg of the Westinghouse company, in a written discussion, advocated the self-cleaning type of insulator because it has given good service in cement-mill installations.

SAFETY PRECAUTIONS

Assuring safety is a dual problem involving safeguarding and education, declared the committee on safety, F. A. Wiley chairman. Detailed methods for carrying out these two activities in a mill were tabulated. Great similarity exists in the safety rules of all the plants, it was found. As a result of its investigations the committee advocates the inclosure of all electrical apparatus.

YARD ELECTRIFICATION AN IMPORTANT PROBLEM

Yard transportation constitutes one of the most important problems in a steel plant, declared R. B. Gerhardt, who briefly presented the elements to be considered under the general headings—power supply, conductor-rail location and construction, and locomotives. A grounded direct-current system, it was pointed out, enables the existing plant equipment to be used. The under-running contact possesses many advantages over other types, a 3-in. x 3-in. billet section serving as a very good conductor rail. Attention was called to the fact that steel men would like to use mill-type motors for their electric locomotives. Swing-bolster trucks and steeple-type cabs are preferred.

IMPROVING EFFICIENCY OF POWER SUPPLY

A generalized and philosophical paper entitled "Improvement in Efficiency of Electric Power Supply" was presented by Dr. C. P. Steinmetz. It was full of suggestions and fundamental economic conceptions. Best economy, he declared, required the separation of power production from the industry served by it, but by-product power should be utilized by the power producer. A splendid discussion of the economic field for the isolated plant, the central station and the central and by-product station constituted the major portion of the paper.

STEEL-MILL ELECTRIFICATION REVIEWED

In itself the equipment and power cost of the electrified mills may not be lower than the same items for mechanical and steam operation, but when all production figures are considered the electrified mill is cheapest, B. G. Lamme and W. Sykes asserted in their paper entitled "A Review of Steel-Mill Electrification." The efficiency of the electrified system, the knowledge of production costs made possible by electrical operation, the flexibility of the installation and the possibility of adjustable speed control are great assets to the electrified mill.

For a long time Europe led America in steel-mill electrification, but today, it was claimed, America builds stronger motors with superior constructional features. In conclusion, the authors assert the possibility of saving about $2.50 per ton of material shipped with electrified mills.

J. S. Unger, Carnegie Steel Company, while discussing B. G. Lamme's and W. Sykes' paper on steel-mill electrification, declared that the steel industry would be completely electrified by 1950. Although the present equipment often develops trouble, he predicted that few shutdowns will be experienced at the end of thirty more years of development.

Dr. C. P. Steinmetz, commenting on present yard

electrification systems, maintained that the storage-battery locomotive had not arrived at its ultimate economical development. The choice between third-rail and overhead construction is determined by local conditions and the type of service desired. Alluding to troubles from electrolysis, he dealt with the usual trolley system with the overhead construction and the rail negative and grounded. He felt that where this positive wire is of sufficient size and where a good ground is maintained trouble from electrolysis should be a minimum.

The annual banquet was held Thursday evening at the Statler Hotel, with Col. H. P. Bope as toastmaster. J. S. Unger drew an amusingly dismal picture of a recurrence of the Dark Ages should iron lose its one essentially important property for the production of electricity, namely, magnetism.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Income from Range and Water-Heater Loads

To the Editors of the Electrical World:

I was interested in the article in the Sept. 2 issue of the *Electrical World* entitled "Income from Range and Water-Heater Loads," but it contains misleading information regarding the utilization of energy for water heating.

Where heaters of large capacity (2½ kw. to 5 kw.) are used with no attempt made to hold hot water in storage for any length of time, the kilowatt-hours used for water heating average for the year about the same as for the electric range. Billed at the figures given in the article cited, the charge for the month for cooking and heating water would be $22.23, of which amount the water heating would amount to $18. As a matter of fact, this statement needs to be qualified by making it clear that the figures given refer to a particular kind of installation—only approved where flat rates for water heating are available—and that the heater is turned on all the time, whether hot water is needed or not.

R. J. PATTERSON,
Electric Range Department.
Walker & Pratt Manufacturing Company,
Boston, Mass.

Transmission-Line Calculations

To the Editors of the Electrical World:

It is well known that a circuit of impedance $\sqrt{R^2 + X^2}$ has a conductance of $R/(R^2 + X^2)$ and that this conductance (as is easily proved by differentiating and equating to zero in the usual way) will be a maximum when the variable R is made equal to constant X. But it appears to have been generally overlooked that the conductance may not be as great as possible when R is as near as possible to X, whereas it always will be as great as possible when $\log R$ is as near as possible to $\log X$.

As the essential point of this arises in connection with many engineering investigations relating to the electrical transmission of energy and other important matters, I will here state and prove the proposition in its most general form.

For all positive and negative values of the variable v, the function $w = av/(bv^2 + c)$ is evidently equal to $a/(bv + c/v)$, a, b and c being constants, some or all of which may be negative. The function will therefore be numerically as great as possible when $bv + c/v$ is numerically as small as possible; or, expressing the same thing in mathematical language that is now fairly usual, $\mathrm{mod}\, w$ will be as great as possible when $\mathrm{mod}\,(bv + c/v)$ is as small as possible. But $\mathrm{mod}\,(bv + c/v)$ and $\mathrm{mod}\,(bv - c/v)$ will be both rising or both falling in value simultaneously. This will be evident from the fact that the squares of these bracketed expressions differ only by the constant $4(bv)\,(c/v)$. It will thus be seen that $\mathrm{mod}\, w$ is as great as possible when $\mathrm{mod}\, bv$ is as near as possible to $\mathrm{mod}\, c/v$, or (since b is constant) when $\mathrm{mod}\, v$ is as near as possible to $\mathrm{mod}\, c/bv$.

For all values of v, however, the geometrical mean of $\mathrm{mod}\, v$ and $\mathrm{mod}\, c/bv$ will be $\sqrt{\mathrm{mod}\, c/b}$. Therefore, logarithms being in arithmetical progression when the corresponding antilogarithms are in geometrical progression, we shall obtain the greatest value of $\mathrm{mod}\, w$ by making $\log \mathrm{mod}\, v$ as near as possible to $\log \sqrt{\mathrm{mod}\, c/b}$. This is very quickly done with the help of an ordinary slide rule; we merely have to set the cursor to c/b on the top fixed scale and to see which of the possible values of $\mathrm{mod}\, v$ is then nearest to the point that the cursor indicates on the bottom fixed scale (this scale being extended to right or left, as may be necessary, with the help of the slide).

W. F. DUNTON.
Newcastle on Tyne, England.

Provisions of Massachusetts Lighting Code

To the Editors of the Electrical World:

I was much interested in R. G. Cushing's letter to you which was printed in the Sept. 2 issue of the *Electrical World* (page 485) and which cited the principal objections raised by electrical engineers to the adoption of an industrial lighting code in the State of Massachusetts. I would like to take this opportunity to correct a wrong impression which otherwise might arise from the third paragraph of Mr. Cushing's letter, in which he states that the proposed code would permit the use of only one specific type of reflector for general lighting, namely, the "RLM" dome. The draft of the Massachusetts code which has come to my attention is entitled "Tentative Lighting Code" and dated January, 1922. The glare rule as it appears in this code is as follows:

1. All lamps in working spaces and placed more than 7 ft. and less than 20 ft. above the floor shall be so shaded that direct light from them shall be cut off down to an angle of at least 15 deg. below the horizontal through the lower end of the filament, except that lamps having an apparent surface brilliancy not anywhere exceeding an intensity equivalent to 15 cp. per square inch and 10 ft. or more above the floor, and lamps neither exceeding this surface brilliancy nor 50 mean spherical candlepower and at least 7 ft. above the floor, need not be so shaded.
2. Lamps in working spaces less than 7 ft. above the floor shall be regarded as for local lighting, and shall be so shaded that direct light from them shall be intercepted down to an angle of at least 30 deg. below the horizontal, and where the work illuminated by them is such as to produce brilliant reflections shall in addition be screened by diffusing surfaces, except for lamps below the workers' eyes and so placed as not to shine therein.

It is obvious that so far as this rule is concerned almost any reflector, whether of metal or of glass, may be employed for general lighting, except those few

styles in which the cut-off is less than 15 deg., that is, less than the shielding angle obtained with such reflectors as the "RLM" dome. The bowl-shaped steel reflectors which have been in use for many years in both porcelain and aluminum finish, and even the tin cone, are all permitted under this rule. Since the code does not require a 15-deg. or any specific angle of cut-off where the brightness of the light source is less than 15 cp. per square inch, it is evident that by the installation of bowl-enameled lamps even shallower reflectors than those listed above may be utilized.

Rule 4—Distribution of Light on Work.—Lamps shall be installed in regard to height, spacing, reflectors or other accessories so as to secure a good distribution of light on the work, avoiding objectionable shadows and sharp contrasts of intensity.

As regards Rule 4, I would concede Mr. Cushing's point that the electrical engineer of a manufacturing plant in endeavoring to comply with the code might be at a loss to know just how far it was necessary for him to go into the matter of providing general illumination. On the other hand, as to the point that better general lighting in turn requires more powerful local lighting, it would appear that this is contrary both to theory and common experience, for otherwise plants receiving the best natural light would be forced to use local lamps of extremely high power. The fact is that where daylight is available in abundance local lamps are seldom, if ever, required.

WARD HARRISON.
National Lamp Works of General Electric Company,
Cleveland, Ohio.

Another Electrical Anniversary

To the Editors of the Electrical World:

The celebration of the birthday of electric lighting which was held in New York on Labor Day brings to mind another anniversary connected with the development of electricity in the last century. Fifty-six years ago, on Sept. 19, the steamer Great Eastern arrived at Liverpool after having completed the laying of the first Anglo-American cable to prove successful. Two cables which had been laid previously had failed to work after short intervals of time.

Upon the arrival of the Great Eastern a big celebration was held in Liverpool and London. Samuel Canning, Daniel Gooch and Captain Anderson were knighted. The following March the United States Congress voted a gold medal to Cyrus W. Field for his exertions in behalf of the transatlantic cable. Even in 1867 Congress could be depended upon to be behindhand in the recognition of home talent.

The original projectors of the Atlantic cable were American capitalists, embracing Peter Cooper, Cyrus Field, Moses Taylor, Marshall Roberts and others, including Professor Morse. The first attempt was a failure, the cable snapping. The second attempt, in June, 1858, also failed during a violent storm. The third attempt was successful as far as laying the cable was concerned, but the insulation gradually became faulty and communication stopped Sept. 4, 1858, a month after it was laid. The second cable to be laid successfully also failed in a short time through insufficient insulation. The third one was the one laid by the Great Eastern.

September seems to have been a good month for cables. In September, 1873, the Anglo-Brazilian cable was successfully laid, and in September of the following year the sixth Anglo-American cable was laid.

Eltingville, N. Y. ROBERT N. STANNARD.

Who Invented the Telephone?

To the Editors of the Electrical World:

The news of the death of Alexander Graham Bell has received conspicuous attention from the European press, but has given rise once more to the "vexata quaestio" as to who was the inventor of the telephone. The question was settled long ago, apparently in a final manner, by the American courts, but the Italian press, while exalting the undeniable merits of Dr. Bell as the first scientist to give the telephone a universal diffusion (in 1876), insist on claiming for Antonio Meucci the credit for the invention. It may be remembered that Meucci was a refugee from Italy at Staten Island, with Garibaldi, and that he sued Dr. Bell when the first practical telephone was placed on the market in the United States.

Sincronizzando, the monthly house organ of the group of Piedmontese Electric Companies in Turin, Italy, says in its August issue:

"On Aug. 2 the American scientist Alexander Graham Bell, generally considered as the inventor of the telephone, died in Nova Scotia. Just now, when we see the insignia of the French Legion of Honor given to a Professor Brauly with the legend 'He invented wireless telegraphy,' while the Italian inventor is still alive, it would be useless to try to claim the invention of the first practical telephone for an Italian, the late Antonio Meucci, who died destitute in New York more than thirty-two years ago.

"But in the case of Dr. Bell even the American courts, surely not suspected of extreme sympathy for poor Meucci, who was dying of starvation on Staten Island with Garibaldi, had to acknowledge that the instrument commercially exploited by Dr. Bell under his own name was but a reproduction, without substantial changes, of the telephone invented by Meucci.

"But even Meucci had been preceded by another Italian from Piedmont, Innocenzo Manzetti. This man had tried successfully as far back as 1861 the first 'talking telephone,' with which he talked clearly from a distance of nearly two miles. According to the news of the times, the invention created quite a sensation in Europe."

The magazine goes on to relate a curious coincidence confirmed by the daily *Corriere della Sera*. It is stated that a few months after these successful experiments in 1861 a stranger called on Mr. Manzetti and was shown the instrument and allowed to test it. On leaving the laboratory, the foreigner handed to Mr. Manzetti his visiting card. It read "Alexander Graham Bell." The card is now in the possession of E. Berardin of Aosta.

EMIL BOSCHETTI.
Turin, Italy.

[The "coincidence" related by our correspondent is indeed "curious," because, according to the biographical dictionaries, in 1861 Bell, then a lad of fourteen, was still living in his native Scotland. Johann Philipp Reis, a German physicist, did, however, produce a telephone in 1860 which not only transmitted musical tones but, according to the late Prof. Sylvanus P. Thompson, Reis' biographer, was expressly intended to and did actually transmit speech as well. An interesting account of the conflicting claims for early telephonic workers, including Reis, Bell, Gray and Dolbear, will be found in the late Prof. E. J. Houston's "Electricity in Every-Day Life"; but no undeveloped invention can detract from the independent and successful achievement of Bell.—EDITORS.]

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Paralleling Three-Phase Transformers

Essential to Ascertain the Internal Connections and to Draw Voltage Diagrams—Methods of Connecting and Possibilities of Paralleling Transformers Outlined

THERE are four fundamental methods of connecting three-phase transformers, namely, delta-delta, star-star, star-delta and delta-star, these methods referring to the arrangements of the primary and secondary windings. By various internal connections there are twelve combinations of voltage relations possible for each of the four fundamental methods. These can be shown conveniently as vector diagrams, the vectors (see *N*, *O*, *P* & *Q* of Fig. 1) representing the primary and secondary voltages and their relations as observed under particular test conditions. By the use of such diagrams transformers may be investigated, and the possibility of paralleling them can be determined. Two transformers having equal voltages and the same connection may be paralleled without change. If their low-tension sides have vector diagrams whose vectors are parallel but of different combinations, simple changes in internal connections will make paralleling possible.

Certain fundamental connections will not parallel and their vectors do not form similar diagrams. These are as follows: Delta-delta cannot parallel with delta-star or with star-delta; star-star cannot parallel with delta-star or with star-delta. Any other arrangements can be paralleled, and by constructing the vector diagrams the combination of connections in any transformers and the necessary changes, if any, can be determined.

The fundamental connection—that is, star or delta in primary and in secondary—must be known in advance. The method of investigation is as follows:

Looking at the high-tension side of the transformer under consideration, letter the three terminals *A*, *B*, *C* from left to right and the low-tension terminals on the opposite side *A'*, *B'*, *C'*, as in *M*, Fig. 1. Connect *C* and *C'* and apply three-phase voltage of low value to the high-tension winding. Then read the high-tension terminal voltages *AB—BC—AC*, low-tension voltages *A'B'—B'C'—A'C'*, and take the four other readings of voltage, *AA'*, *BB'*, *BA'* and *B'A*. From these ten voltage readings and the accompanying table it will be evident which combination exists in any transformer. By means of *N*, *O*, *P* and *Q* in Fig. 1, its voltage diagram can be picked out and sketched. By doing this for both transformers it can be determined whether they can be paralleled.

There are twelve combinations for each of the four methods of connection, or forty-eight possible combinations in all. If after drawing the vector diagrams they are found to be made up of similar triangles or stars, then the transformers can be paralleled without internal changes by connecting to the same line the leads represented by the corners of the triangles that correspond. For instance, in Fig. 2 (*R*-1) the triangles are similar, though not arranged exactly alike, and the two transformers will parallel on the low-tension side if connected as in (Fig. *R*-2), putting A'_1 and C'_2 together, B'_1 and A'_2 together, and C'_1 and B'_2 together. If the diagram of the two transformers were as shown in Fig. 2 (*S*), one of the low-tension diagrams standing on its point and the other on one of its sides, the two transformers would not parallel without a change in the internal connections of one of them.

To draw the vector diagrams for a given transformer connection proceed as follows: Assuming a transformer which is delta-connected on both high and low tension as an example, draw the diagram of the coils as in Fig. 2 (*T*-1) and number the start and finish of each coil. Then, as both high tension and low tension are connected delta, the lead *A*, *B* or *C* joins the ends of windings on two legs of the core. Thus *A* joins 1 and 4 on the high tension, etc. Start the vector diagram by drawing a triangle to represent the high-tension windings and lettering it as shown in Fig. 2 (*T*-2) (always letter the high-tension diagram in the order shown, *A*, *B*, and *C*, left-hand rotation). Looking at Fig. 2 (*T*-1), the ends of the windings that are connected together at lead *A* are 1 and 4; *B*, 3 and 6; *C*, 5 and 2; so similar numbers can be placed on lines *AB*, *BC*, and *CA*, as shown in Fig. 2 (*T*-2). To draw the low-ten-

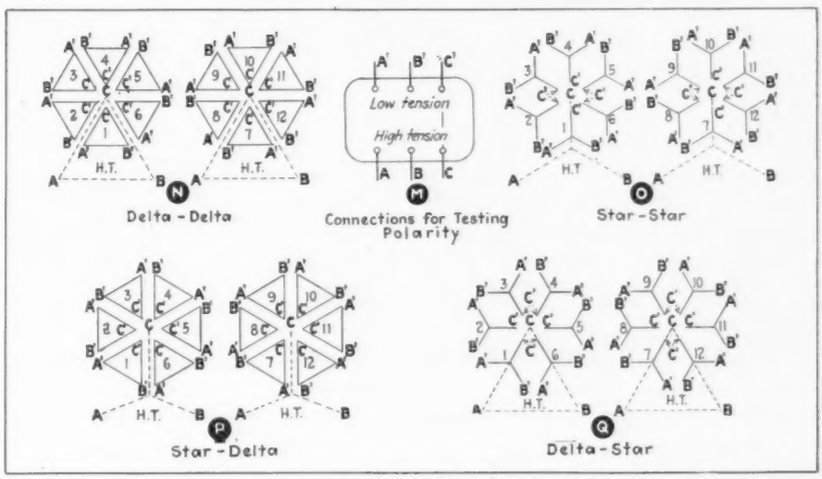


FIG. 1—STANDARD CONNECTIONS FOR THREE-PHASE TRANSFORMERS

VOLTAGE READINGS FOR CONSTRUCTING VECTOR DIAGRAMS OF THREE-PHASE TRANSFORMERS

Sign ">" means "greater than" and "<" means "less than." See drawing for meaning of AB, etc. Combination numbers and letters N, O, P and Q refer to drawing.

DELTA TO DELTA (SEE FIG. 1, N)

Combination			
1	$AA' = BB'$ and $< AB'$	$BA' > BB'$	$AA' = AC' - C'A'$
2	$AA' = BB'$ and $> AB'$	$BA' > BB'$	$AB' = AC' - C'B'$
3	$AA' = BB'$ and $> AB'$	$BA' > BB'$	$BA' = BC + C'A'$
4	$AA' = BB'$ and $> AB'$	$BA' < BB'$	$BB' = BC + C'B'$
5	$AA' = BB'$ and $< AB'$	$BA' < BB'$	$AB' = AC + C'B'$
6	$AA' = BB'$ and $< AB'$	$BA' < BB'$	$BA' = BC - C'A'$
7	$AA' = BB'$ and $> AB'$	$BA' < BB'$	$AB' = AC - C'B'$
8	$AA' < BB'$ and $< AB'$	$BA' < BB'$	$AA' = AC - C'A'$
9	$AA' < BB'$ and $< AB'$	$BA' < BB'$	$BB' = BC + C'B'$
10	$AA' = BB'$ and $< AB'$	$BA' > BB'$	$BA' = BC + C'A'$
11	$AA' > BB'$ and $> AB'$	$BA' > BB'$	$AA' = AC + C'A'$
12	$AA' > BB'$ and $> AB'$	$BA' > BB'$	$BB' = BC - C'B'$

STAR TO STAR (SEE FIG. 1, O)

Combination			
1	$AA' = BB'$ and $< AB'$	$BA' > BB'$	$AA' = AC - C'A'$
2	$AA' = BB'$ and $> AB'$	$BA' > BB'$	$AB' = AC - C'B'$
3	$AA' = BB'$ and $> AB'$	$BA' > BB'$	$BA' = BC + C'A'$
4	$AA' = BB'$ and $> AB'$	$BA' < BB'$	$BB' = BC + C'B'$
5	$AA' = BB'$ and $< AB'$	$BA' < BB'$	$AB' = AC + C'B'$
6	$AA' = BB'$ and $< AB'$	$BA' < BB'$	$BA' = BC - C'A'$
7	$AA' = BB'$ and $> AB'$	$BA' < BB'$	$AB' = AC - C'B'$
8	$AA' < BB'$ and $< AB'$	$BA' < BB'$	$AA' = AC - C'A'$
9	$AA' < BB'$ and $< AB'$	$BA' < BB'$	$BB' = BC + C'B'$
10	$AA' = BB'$ and $< AB'$	$BA' > BB'$	$BA' = BC + C'A'$
11	$AA' > BB'$ and $> AB'$	$BA' > BB'$	$AA' = AC + C'A'$
12	$AA' > BB'$ and $> AB'$	$BA' > BB'$	$BB' = BC - C'B'$

STAR TO DELTA (SEE FIG. 1, P)
OR
DELTA TO STAR (SEE FIG. 1, Q)

Combination		
1	$AA' = BB'$ and $= AB'$	$BA' > BB'$
2	$AA' = BB'$ and $> AB'$	$BA' > BB'$
3	$AA' = BB'$ and $> AB'$	$BA' = BB'$
4	$AA' = BB'$ and $= AB'$	$BA' < BB'$
5	$AA' = BB'$ and $< AB'$	$BA' < BB'$
6	$AA' = BB'$ and $< AB'$	$BA' = BB'$
7	$AA' < BB'$ and $= AB'$	$BA' < BB'$
8	$AA' < BB'$ and $< AB'$	$BA' < BB'$
9	$AA' < BB'$ and $< AB'$	$BA' = BB'$
10	$AA' > BB'$ and $= AB'$	$BA' > BB'$
11	$AA' > BB'$ and $> AB'$	$BA' > BB'$
12	$AA' > BB'$ and $> AB'$	$BA' = BB'$

sion diagram draw lines parallel to the three sides of the high-tension diagram and number them in the reverse order to indicate that the secondary induced voltage is opposite in phase to the impressed voltage. This gives Fig. 2 (T-3), and referring back to Fig. 2 (T-1), the low-tension sides 1 and 4 are connected and brought out at A', 3 and 6 are connected together to make B', and 5 and 2 are connected to make C'. Rearranging the two diagrams and connecting C' and C, Fig. 2 (T-4) is obtained, which, on comparison with Fig. 1 (N) proves to be combination No. 4.

Assume that this transformer, connected according to combination No. 4, is to be reconnected to parallel with a transformer connected according to No. 3 of the delta-delta group, a vector diagram of which is shown in Fig. 2 (U-1). Assume that the reconnecting is to be done on the low-tension windings. The high-tension winding being connected the same as Fig. 2 (T-1), its vector diagram will be the same and will be numbered like Fig. 2 (U-2). Numbering the sides of the low-tension triangle in the same way as Fig. 2 (T-3) (voltages opposite to primary) gives Fig. 2 (U-3). By comparing this with Fig. 2 (T-3) it is seen that B' of Fig. 2 (U-3) can be formed by connecting 2 and 3 of Fig. 2 (T-3), C' is 4 and 5, and A' is 1 and 6. The original low-tension connections, combination No. 4 shown in Fig. 2 (T-1), must therefore be changed to be as shown in Fig. 2 (V), which is combination No. 3 of the delta-delta group.

JAMES DIXON.
Reliance Electric & Engineering Company, Cleveland, Ohio.

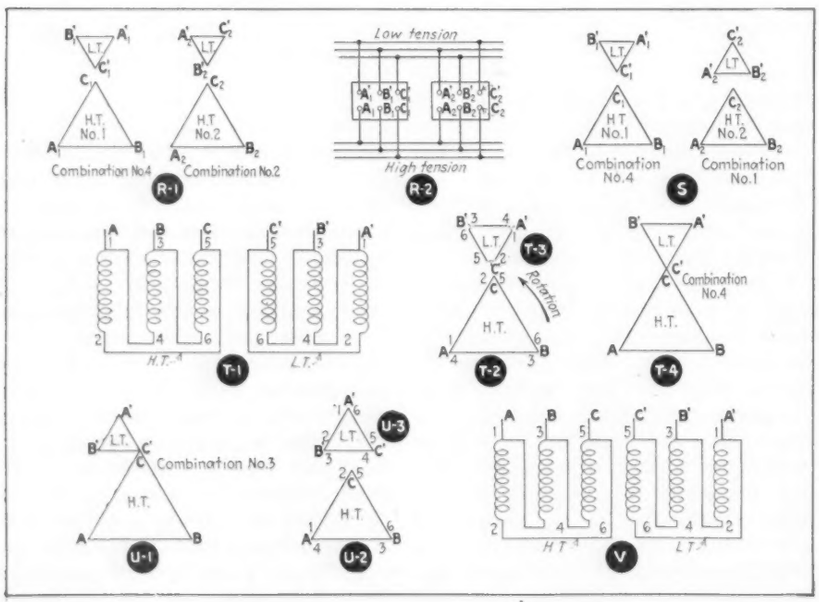


FIG. 2—DIAGRAMS SHOWING HOW POLARITY OF UNMARKED TRANSFORMER IS DETERMINED

Carrier-Current Sets for Central Stations

CONSIDERABLE progress has been made in the development of carrier current, or "wired wireless," applicable to communication between power stations over the transmission circuits of the system, according to the report of the electrical apparatus committee of the Pennsylvania Electric Association presented at the annual convention held at Bedford Springs, Pa., on Sept. 6-9.

The 50-watt sets now on the market have a range of 85 miles on untapped transmission lines. Designs are now under way for 250-watt sets having a range of 250 miles when used with single-span antenna placed approximately 15 ft. below the power cables. Taps to transmission lines reduce this range approximately 10 miles per tap, irrespective of length of branch line.

A call-bell system is used as in standard commercial telephones, so that the constant attention of an attendant is not necessary. A licensed operator is not required, as these sets will not broadcast over any great range—the transmission circuits serve to limit this feature. Similarly, the carrier-current system is unaffected by external broadcasting and by atmospheric disturbances. Thunderstorms cause no greater disturbance than the usual click on the receiver.

The present sets now developed are not suitable for duplex use, as in standard telephones, as it is necessary to press a button while talking and release the button while listening. Developments are now under way to make duplex conversations possible.

The power required for transmitting is derived from a ½-kw. motor-generator set, which furnishes 1,000 volts direct curent for the plate circuits and 88 volts single-phase for the step-down transformers for heating the filaments of the transmitting tubes. A storage battery furnishes current for the filaments of the receiving tubes and for the relays used in the call-bell system.

Lifting the receiver from the hook automatically starts the motor-generator set and places the transmitting tubes in service. The receiving tubes are normally in circuit at all times as they operate the call-bell system.

The maintenance of these stations consists primarily of "radiotrone" renewals and amounts to approximately $20 per month per station. The cost of this equipment is approximately $2,000 per station.

There are at present about twenty-five sets in process of manufacture in Connecticut and New York State for several of the large power companies of the South. None of the sets is in commercial use as yet, although it is anticipated that delivery will be made this fall.

An experimental set is transmitting very satisfactorily over a 30-mile transmission line, operating at 33,000 volts. The quality of speech is much clearer and rounder than in the standard telephone circuits between the two points.

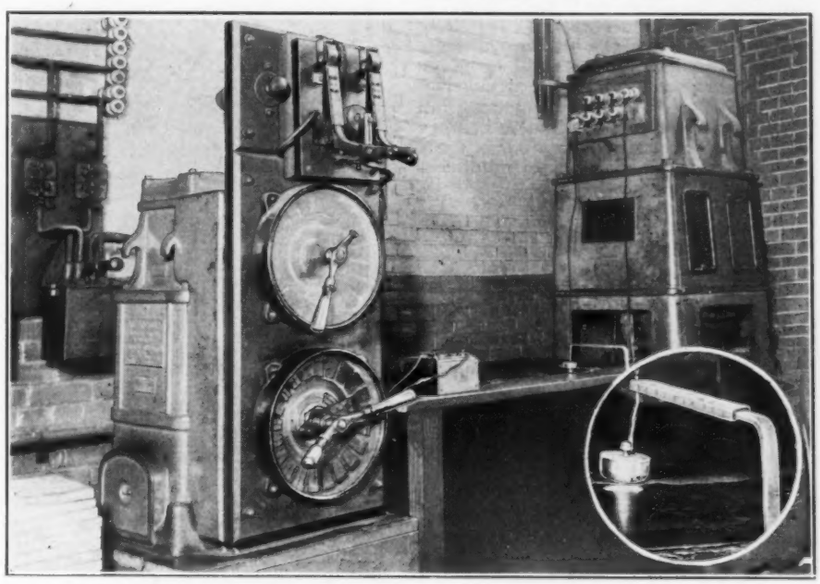
Portable stations now under developments for use on motor trucks will be able to send, receive and signal the power stations when brought into close proximity to the transmission lines. Portable sets for patrolmen will also be available later for sending and receiving, but not for calling.

Among the advantages of the carrier-current system over standard metallic lines are freedom from inductive interference, freedom from interference due to broken telephone circuits, elimination of lighting disturbances, reduced cost of construction and maintenance, and clear and better transmission than can be obtained on private transmission-line telephone circuits.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Test for Dielectric Strength of Sheet Insulation

A NEW method of testing the momentary dielectric strength of sheet-insulating materials like varnished cambric has been proposed by the American Society for Testing Materials. It is not to be considered as indicating the permanent dielectric strength of the material, as breakdown will take place at a lower voltage when applied for a greater length of time. Criticisms are solicited by the committee on electrical insulating materials and should be directed to H. S. Vassar, secretary of the committee, 102 River Street, Newark, N. J.



METHOD OF DETERMINING MOMENTARY DIELECTRIC STRENGTH OF SHEET INSULATING MATERIAL

The character of apparatus necessary to make the test, the nature of electrodes and test specimen and the mode of procedure are given in the paragraphs that follow:

I. *Apparatus.* — Any well-designed, high-tension transformer connected to an alternating-current supply, having as nearly a true sine wave as possible, may be used. The transformer and the source of supply of energy shall be not less than 2 kva. for voltages of 50,000 volts or less, and not less than 5 kva. for voltages above 50,000 volts. The frequency shall not exceed 100 cycles per second.

Regulation shall be so controlled that the high-tension testing voltage taken from the secondary of the testing transformer can be raised gradually from any point and in no case more than 500 volts at a step. The control may be made by generator-field regulation, with an induction regulator, or with a variable-ratio auto-transformer. Any method of regulating the voltage is satisfactory which does not distort the wave more than 10 per cent from a sinusoidal shape.

The voltage may be measured by any approved method which gives root-mean-square values, preferably by means of a voltmeter connected to a special voltmeter coil in the high-tension winding of the testing transformer, or to a separate step-down-instrument potential transformer. A voltmeter on the low-tension side of the transformer is satisfactory, if the ratio of transformation does not change under any test condition. An electrostatic voltmeter properly calibrated in the high-tension circuit is also satisfactory. A spark gap may be used to check the readings at very high potentials.

Some protection is desirable in the high-tension circuit of testing transformers where the potential is 25,000 volts or over, to prevent dangerous surges and limit the current when the test specimen is punctured. It is, however, desirable to have as much energy available as possible when puncture occurs. If impedance in the form of choke coils is used in series with the high-tension terminals, it should not be greater than that which will limit the high-tension current to double the normal rated current of the testing transformer.

When a spark gap is used, a non-inductive resistance of about 1 ohm per volt should be inserted in series with one terminal of the spark gap, to damp high-frequency oscillations at the time of breakdown and limit the current flow. This resistance shall be as near the gap as possible. If the test is made with one side grounded, this resistance shall be on the ungrounded side of the circuit, and if neither side is grounded, the resistance shall be inserted one-half on each side of the spark gap. Water-tube resistors are preferable to carbon for this purpose, as carbon resistance may be materially decreased by the passage of current.

The apparatus used and the method of measuring the voltage shall meet the requirements of the standardization rules of the American Institute of Electrical Engineers.

II. *Test Specimens.* — The electrodes shall be of brass or copper, 1 in. thick

and 2 in. in diameter. The edges shall be rounded to a radius of ¼ in. The contact surfaces shall be flat and polished.

The test specimens may be of any convenient size, but the total area of the specimens of one sample of material shall be sufficient to permit making at least ten satisfactory tests. The specimens shall be representative of the material to be tested, care being taken to select material which is free from abnormal defects such as blisters, wrinkles, cracks, etc.

III. *Procedure.* — The tests shall be made in air with the specimen at room temperature.

The testing electrodes shall be kept clean and polished. The electrodes shall be self-aligning and shall be placed exactly opposite one another.

Starting at zero, the testing voltage shall be increased uniformly at such a rate that puncture will take place in from ten to fifteen seconds. Ten tests shall be made, and the average of these ten puncturing voltages shall be taken as the momentary dielectric strength.

The thickness of the specimen shall be measured at each puncture, using a ratchet micrometer graduated to 0.001 in. and having a circular foot not less than 0.240 in. nor more than 0.260 in. in diameter.

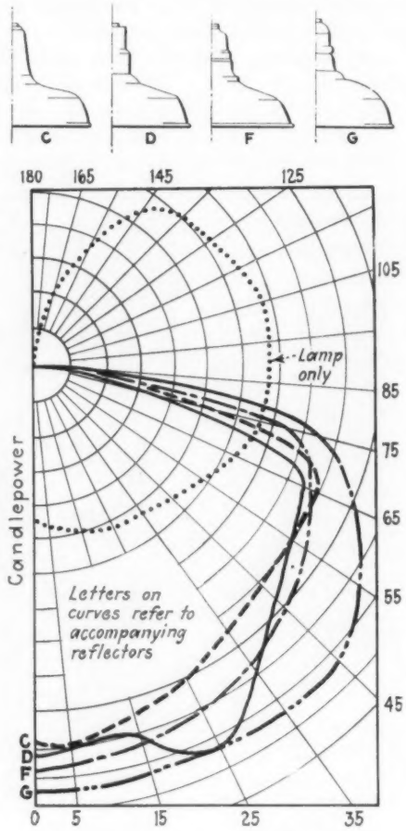
The report shall include the following: (a) The thickness of the specimen at each puncture; (b) total volts and volts per mil of thickness at each puncture; (c) the average, maximum and minimum volts at puncture per mil thickness for each samp'e; (d) the room temperature, and (e) the relative humidity, in per cent.

F. M. FARMER,
Chairman Committee on
Electrical Insulating Materials.
American Society for Testing Materials,
New York.

"RLM" Dome Reflectors with Certified Labels

THE results of tests made by the writer on seven makes of reflectors furnished by the manufacturers early in the "RLM" standardization movement were published in the *Electrical World* of Aug. 12, 1922, page 330. These reflectors were not labeled by the Electrical Testing Laboratories.

The accompanying data are the result of a second series of tests on new "RLM" reflectors with 400-watt, 125-volt "Mazda C" lamps. These reflectors have the "RLM" label. It may be noted that much more uniform results are now obtained in the candlepower curves. Mechanical and thermal improvements have also been made. On the curves and outlines the same letters are used on the respective makes of reflectors as in the first series of tests. It is believed that all four of the reflectors treated herein show improvements because of the testing and labeling of the Electrical Testing Laboratories. The user may be sure that he is receiving the "RLM" standard-dome reflector when he sees the certified label.



REFLECTORS LABELED BY ELECTRICAL TESTING LABORATORIES SHOW IMPROVEMENT IN LIGHT DISTRIBUTION

It is believed that the distribution values and the efficiencies shown by the candlepower curves are so alike in all "RLM" reflectors that mechanical and thermal characteristics alone need be considered when standardizing on a make of reflector of this specification.

D. W. BLAKESLEE,
Electrical Engineer.
Jones & Laughlin Steel Company,
Pittsburgh, Pa.

MECHANICAL, THERMAL AND ILLUMINATION COMPARISONS OF "RLM" STANDARD DOME REFLECTORS

	Reflector C	Reflector D	Reflector F	Reflector G
Enamel	Slightly pitted and spotted	Slightly pitted and spotted	Slightly pitted and spotted	Pitted and spotted
Cracking of enamel under pressure at largest diameter	None	None	At edge	At center and edge
Socket	Light, two-piece	Heavy, two-piece	Light, two-piece	Very heavy one-piece
Socket held from turning	Yes	Yes	Yes	Yes
Number of outside pieces	One	Two	Two	Two steel, one cast iron
Nut	Heavy	Heavy	Light	Very heavy
Gaskets	Fiber	Rubber	Lead, asbestos	Fiber, copper
Reflector rolled	Under	Under	Over, well filled	Under
Weight in pounds	5	5	4½	5½
Temperature rise in socket, deg. F.	103	80	86	73

Limiting Sapwood a Fallacy

A COMMON fault of engineers is to use the same specification for timber which is to have an effective preservative treatment as for timber to be used untreated. A much better treatment is insured by specifying timber without sapwood limitations, since the sapwood takes the preservative much more readily than the heartwood. When timber is to be used untreated, however, and durability is desired, a large percentage of heartwood should be specified, since the heartwood of most species is considerably more durable than the sapwood.

Material which contains considerable sapwood, particularly Southern pine, can be obtained at less cost than that which contains a large percentage of heartwood; therefore failure to distinguish between specifications for timber to have a preservative treatment and that to be used untreated is not only inconsistent with best practice but results in an increased cost.

These facts are also recognized by the American Society for Testing Materials, and their specifications for Southern pine timber to be creosoted require at least 30 per cent sapwood in cross-section. "All-heart" or "85 per cent heart" pine is frequently specified by engineers not particularly familiar with timber, since they undoubtedly believe the heartwood is actually stronger than the sapwood. This is an erroneous impression, however, and in more than 300,000 tests made by the Forest Products Laboratory no effect on the mechanical properties of wood due to the change from sapwood to heartwood has ever been noticed.

P. R. HICKS,
Secretary-Manager.
American Wood Preservers' Association,
Service Bureau,
Chicago, Ill.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Functions of a Merchandising Department

Appliance Sales Should Increase Load, Earn a Profit and Build Good Will for the Central Station

By C. Ernest Greenwood
Superintendent Appliance Department,
Edison Electric Illuminating Company of Boston

CENTRAL-STATION commercial men will no doubt agree that until very recent years no department of the business has had to travel such a rough road or been subject to such an atmosphere of mere toleration as have the merchandising departments. There was no one particular reason for this attitude, but if all cases were analyzed, it is a fair guess that in general the merchandise department was considered a necessary evil and treated as such. Frequently it was found that the supervision of selling appliances had been placed in the hands of an engineer as a side issue or in the hands of some one unfitted because of his lack of merchandising knowledge or merchandising instinct. The management of the merchandising department not being considered a full-sized job, the result was often supervision by a person without much business ability. His job was to "oversee" the sale of appliances.

The result was natural enough. A department that should have been a distinct asset became a liability, an expense seemingly unjustified. Customers became dissatisfied, the trade likewise, and the small business became smaller and died out.

A live man in charge of merchandising appliances was looked upon by men in other departments of the company as a mild bolshevist. His merchandising viewpoint could not be appreciated by those not having to cope with his problems, the greatest of which was to synchronize his work with the other activities of the company.

Fortunately, the standing of the central-station merchandise branch has now reached a much higher plane. It has had consideration by the executives of the company. By reason of the manufacture of new and more efficient electrical labor savers, because of millions of dollars' worth of national advertising to tell the public about them, because of year-round diligence on the part of progressive central-station companies to bring the manufacturer's story to users of electricity and create a market, a demand has arisen for electrical devices in home, office and factory.

C. E. GREENWOOD

The electric service customer looks to the central-station company for guidance in selection, for instruction in proper use and for maintenance service or a medium for that service.

A discussion of whether the central-station company should take upon itself the merchandising of the devices or simply promote them is irrelevant here. Generally speaking, it is a local problem, but in passing I would venture the opinion that through aggressive promotion and sales of electrical devices by the central-station company with high-class service stores, operated on strictly merchandising principles and in fair competition, a healthier merchandising business can be built up for other electrical merchants in most communities. Statistics show that in many communities where the electric light and power companies do not merchandise a thriving business is done by dealers. But there are no statistics to prove that a more vigorous business might not be done by all dealers if the same companies were aggressively merchandising on true cost principles.

The modern merchandising branch of the central station has a threefold value:

1. From a load-building point of view it is placing "current-consuming" devices on the lines. "They are seldom used," says an anti-merchandiser. Some may not be used often, but the day when from $10 to $25 is invested in a nickel-plated electrical device just to fill an ornamental purpose along with bric-à-brac has, in the writer's opinion, disappeared. It is generally agreed that the larger labor savers—washing machines, vacuum cleaners, etc.—when once in the home, mean to the supply company added income without added investment.

2. Unlike the commercial departments, the merchandising department has the problem of increasing the load and in addition making a profit on the sale of appliances. To the merchandise man this is the all-important factor. To make profit means operation on a cost basis and precludes running a so-called cut-price establishment. It is easy to put appliances on the line for the purpose of load building only. It is a real job, though, to put them on the lines at a profit. This is of paramount importance and is the vital point in successful merchandising.

3. Finally, the merchandising department creates good will and helps strengthen this important asset of any public utility. If the department functions properly, it sells a service with every device. Every de-

vice enhances the value of the company's service.

Each appliance represents a point of contact. Light is a beautifier and comforter in the home, but the great appeal of electric service comes through the easing of laborious tasks such as clothes washing, dish washing, ironing and sewing and making cooking processes more pleasant and interesting. Many separate services are rendered by the central-station company through appliances. In fact, the term "lighting bill" has become a misnomer; it is now a "service bill." And the price the customer pays for all these services in any one month is of diminishing importance in his mind as the number of appliances or the number of home services rendered increases. Even the use of energy for light is built up through merchandising if portable lamps are sold.

All these touches of satisfaction, in addition to the all-important one of the personal, courteous contact in the numerous calls to buy merchandise, make closer the bond between central-station company and customer. They promote good will.

We must bear in mind, too, that because of the many points of contact and the dependence of customers on the electrical conveniences there are just that many chances of a slip-up in the service. The human element enters into every transaction, and personnel and personal service, which are vital factors in successful management, must be kept at a high standard.

More central-station merchandising departments are on a substantial basis both financial and ethical than ever before. They are functioning properly, and the recognition of their true value to the electric light and power company has earned them the place they have so long deserved. No successful business can afford to give its sales department secondary consideration, least of all a public utility which depends upon public good will for its existence. It only remains for those men in charge of appliance sales to conduct their merchandising activity with sound business sense and along ethical lines.

Investment Cost of New Customers Averages $250

BASED upon the records showing that the increase of customers of the Dallas (Tex.) Power & Light Company has averaged 3,175 a year for the last two years, it is estimated by C. E. Calder, president of the company, that the amount of capital to be required for the next several years in providing new equipment adequate to meet the demand for electricity will amount to $793,750 a year. This estimate is based on the records of the company, which show that the average total investment cost per new customer has been $250.

The growth of Dallas and the increasing use of electricity for light and power makes the demand for plant extension in this city unusually heavy. The company is now arranging for an addition to its plant to be built at a cost of $2,000,000, which is needed at this time to meet demand for increased electrical energy by Dallas consumers.

The Dallas Power & Light Company is meeting the demand for new capital to provide necessary extensions and improvements in its plants by the sale of securities to its customers, and a campaign is now being conducted for the sale of 7 per cent preferred cumulative stock to users of electricity in that city.

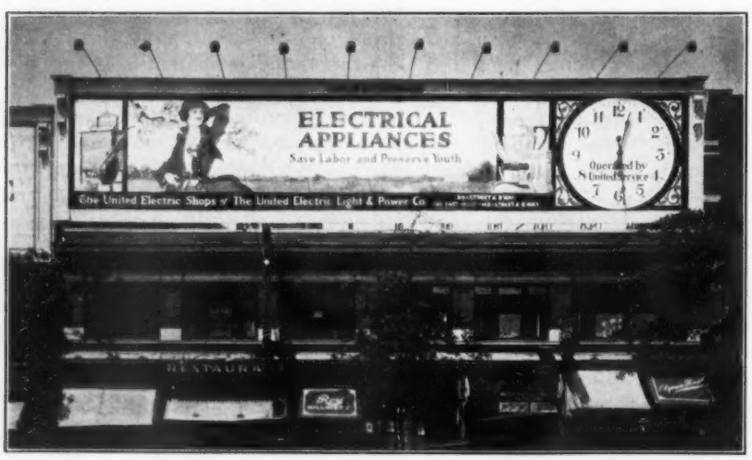
Electric Clock Advertises Reliability of Service

A VALUABLE bit of advertising for its service is obtained by the United Electric Light & Power Company of New York City through the illuminated outdoor billboard shown here, the feature of which is a large clock electrically operated by the company's 110-volt service. The clock was developed and built by the company, and it is believed to be the first time that a synchronous motor has been used for an outdoor clock, especially for one which in size is the second largest in all New York.

The hands of this clock are operated by a 4-watt, 60-cycle synchronous Warren motor and a $\frac{1}{8}$-hp. motor through a relay as shown in the schematic diagram. The synchronous motor, through reduction gears, revolves contact *A* at the rate of four revolutions per minute. As contact *A* revolves it touches contact *B*, energizing the relay, which feeds a $\frac{1}{8}$-hp. single-phase motor driving the hands of the clock. Contact *B* is attached to the minute-hand shaft, thus rotating with the minute hand approximately one-fourth of a minute, setting the clock three or four times per minute.

The clock has now been in operation for nearly five months and has required virtually no attention as it has kept absolutely accurate time with the Warren master clock located at the company's Sherman Creek station.

Because of the accurate time this



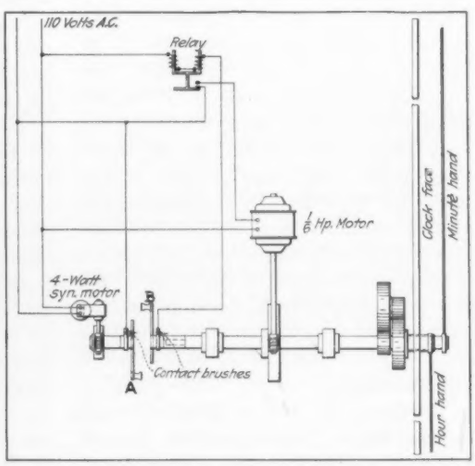
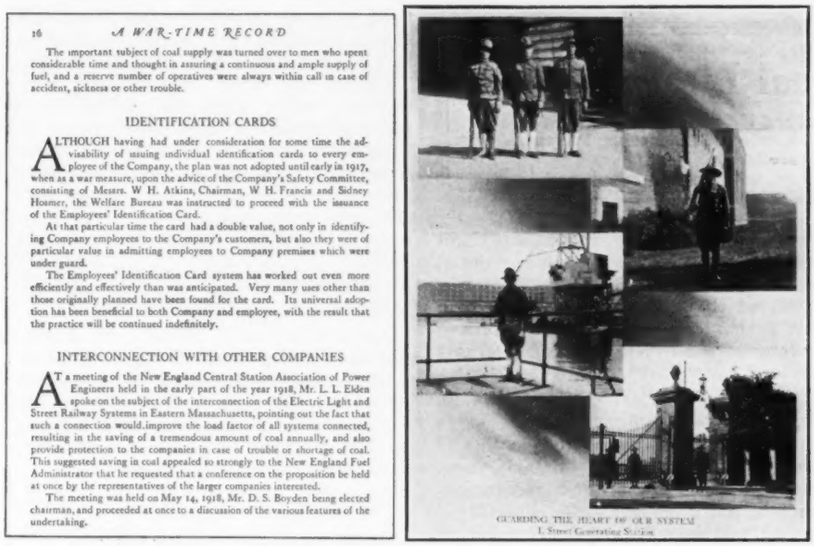


DIAGRAM SHOWING BILLBOARD AND CONNECTIONS FOR ELECTRICALLY OPERATED CLOCK



16 *A WAR-TIME RECORD*

The important subject of coal supply was turned over to men who spent considerable time and thought in assuring a continuous and ample supply of fuel, and a reserve number of operatives were always within call in case of accident, sickness or other trouble.

IDENTIFICATION CARDS

ALTHOUGH having had under consideration for some time the advisability of issuing individual identification cards to every employee of the Company, the plan was not adopted until early in 1917, when as a war measure, upon the advice of the Company's Safety Committee, consisting of Messrs. W H. Atkins, Chairman, W H. Francis and Sidney Hosmer, the Welfare Bureau was instructed to proceed with the issuance of the Employees' Identification Card.

At that particular time the card had a double value, not only in identifying Company employees to the Company's customers, but also they were of particular value in admitting employees to Company premises which were under guard.

The Employees' Identification Card system has worked out even more efficiently and effectively than was anticipated. Very many uses other than those originally planned have been found for the card. Its universal adoption has been beneficial to both Company and employee, with the result that the practice will be continued indefinitely.

INTERCONNECTION WITH OTHER COMPANIES

AT a meeting of the New England Central Station Association of Power Engineers held in the early part of the year 1918, Mr. L. L. Elden spoke on the subject of the interconnection of the Electric Light and Street Railway Systems in Eastern Massachusetts, pointing out the fact that such a connection would improve the load factor of all systems connected, resulting in the saving of a tremendous amount of coal annually, and also provide protection to the companies in case of trouble or shortage of coal. This suggested saving in coal appealed so strongly to the New England Fuel Administrator that he requested that a conference on the proposition be held at once by the representatives of the larger companies interested.

The meeting was held on May 14, 1918, Mr. D. S. Boyden being elected chairman, and proceeded at once to a discussion of the various features of the undertaking.

GUARDING THE HEART OF OUR SYSTEM
L Street Generating Station

TWO PAGES FROM BOSTON EDISON COMPANY'S "WAR-TIME RECORD"

billboard has come to be a landmark in the neighborhood, and the clock is a constant reminder of the reliability of the company's service.

War-Time Record of Boston Edison in Book Form

ELECTRIC light and power companies in the United States played an amazingly important and diversified part in the world war, but few people have realized the scope and value of this service outside governmental offices and the higher executive circles of the public utility industry. The main task of supplying energy for the production of munitions, transportation of troops and supplies, lighting of cantonments, operation of naval bases, etc., has received more or less publicity as the central corporate activity of the electric service organization, and the splendid record of individual employees with the colors, of course, surpasses all other achievements. What a range of activities a single company and its personnel attained, however, is admirably illustrated in "A War-Time Record," published privately by the Edison Electric Illuminating Company of Boston, under the able editorship of Edward S. Mansfield, historian of the organization and in charge of the department of field-service statistics.

The Boston company's record as printed is believed to be the first of its kind among American central-station companies. It reviews in 108 pages all the major activities of the organization as an auxiliary to war preparation and service, and the work of individuals in that connection is outlined. The effect of the war upon operation, the problem of plant enlargements, the work required for fuel supply, the trend of economies in station performance and the construction of additional lines and substations to serve arsenal, shipyard and munition-plant requirements are outlined. Interesting accounts are made of the company's preparedness activities, the work of President C. L. Edgar upon the Naval Consulting Board of the United States, the Organization for Industrial Preparedness, the National Committee on Gas and Electric Service, and work in other important fields, and the co-operation of the company and its employees in welfare and relief work, the raising of Liberty loan funds, interconnection with other companies, and many other topics are discussed. Measures adopted to protect company property, the treatment of employees, use of women operators in substation and stockroom service, the trend of rates during the war, canvass of aliens of the company, food production, the N. E. L. A. convention of 1918 and special services rendered by members of the company, are touched upon, with many illustrations at home and in the field, here and overseas.

The record closes with an "honor roll" giving the military and naval records of all employees who were with the colors, accompanied by reproductions of photographs taken at the front by members of the company and a casualty list with photographs and records of the eleven employees who lost their lives. The total number of employees listed as in the service is 444, nearly one in five of those on the payroll having been with the colors.

What Other Companies Are Doing

Worcester, Mass.—A residential survey has just been completed by the Worcester Electric Light Company, with the result that 31,425 installed meters were disclosed out of a total prospective installation of 41,683, or a saturation of 75.4 per cent. It required seven months and twenty-five days to complete the survey at a cost of $882.10, of which $816 represented wages and the balance car fares. Streets were covered in alphabetical order. The company's total number of commercial lighting meters has increased 1,270 per cent in eleven years.

Augusta, Me.—In a five weeks' campaign for house-wiring contracts recently concluded by the Central Maine Power Company 2,214 contracts were secured at a total cost of soliciting, advertising and clerical service of about $1,800. The quota assigned was 2,000 contracts. Personal solicitation by employees, preceded by newspaper advertising and a few letters sent directly to prospective customers achieved the above result. R. G. Webber was in charge of the campaign.

Joliet, Ill.—A historical exhibit is being staged by the Public Service Company of Northern Illinois in its salesroom which traces the evolution of electric appliances from the crude beginnings to their present status of development. One exhibit shows the complete evolution of artificial lighting devices.

Boston, Mass.—Additional energy to the extent of 4,000,000 kw.-hr. over and above the normal growth of lighting business has been sold by the Edison Electric Illuminating Company as a result of the activities of its illuminating engineering department. Betterment installations in industrial plants and mercantile establishments of the Boston metropolitan district constitute an important part of this service, supplemented by a "Bureau for Better Illumination" maintained in Boston along co-operative lines by the various branches of the local electrical industry. J. Daniels is illuminating engineer of the Boston company.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Fuel Economy in Steam-Power Plants.—JOHN B. C. KERSHAW.—The prevention of waste in connection with the industrial use of fuel for power generation is of utmost importance, and in a series of articles commencing in this issue the author presents information and data pertinent to the subject. In the first article he considers the composition and constitution of natural and artificial fuels and the chemistry of the combustion process. The fuels include wood, peat, lignite, bituminous coal, semi-bituminous coal and anthracite coal.—*Beama*, July, 1922.

Nipigon Hydro-Electric Power Development.—Characteristics of the plant and reasons for its construction are set forth. This development is on the Nipigon River, which flows from Lake Nipigon to Lake Superior in Ontario. The ultimate development will be for 75,000 hp., while at present two units are completed and in operation for 12,500 hp. each. A description is given of the power house, electrical equipment, pumping equipment, etc.—*Canadian Engineer*, Aug. 1, 1922.

Hydro-Electric Power-Plant Design.—J. A. SIRNIT.—The best way to maintain the full capacity of a hydraulic power plant during flood periods is to remove the high tailwater from the discharge opening. This may be successfully accomplished by a backwater suppressor utilizing the waste water, and the article is chiefly devoted to the development and application of this method. Two testing models are described and the results presented, while the design of the draft-tube orifice is discussed at some length. The plant of the Alabama Power Company at Mitchell Dam on the Coosa River in Alabama, where the Thurlow type of suppressor is applied, is described.—*Mechanical Engineering*, August, 1922.

Transmission, Substations and Distribution

Combination Transformer and Converter.—A machine called the "transverter" is described which is a combination of the transformer and converter as ordinarily used. Instead of transmitting by three-phase alternating current this machine makes it possible to supply at once to the distribution system high-pressure direct current. The apparatus consists in the main of a transformer for stepping up the pressure of the three-phase current and has several rotating commutators for converting the alternating current into direct current. The commutators are connected in series so that the direct-current pressure of each is added to the one preceding it. An experimental unit has been working for sixteen months at a pressure of 100,000 volts, but it is estimated that this might be increased to a probable limit of 200,000 volts.—*Bulletin of the Department of Overseas Trade*, August, 1922.

Centrifugally Cast Reinforced-Concrete Poles.—M. FOERSTER.—A large part of a 200-mile transmission line in Sweden, operating at 110,000 volts, was equipped with round reinforced-concrete poles made by the centrifugal casting method. The poles consist of two vertical members connected near their upper end with a horizontal bar made likewise of concrete. According to the different wire-load conditions, four different sizes of poles have been used, the average dimensions being a height of 57 ft., a bottom diameter of 20 in. and a top diameter of 9 in. More than 5 per cent of the poles have been subjected to mechanical tests. They have withstood double the guaranteed top pull without visible deformation and began to develop cracks at eight times this stress. In no case did an actual break occur. The poles were transported, ready for use, over a long distance by rail and water, with no detrimental effects.—*Elektrische Kraftbetriebe und Bahnen*, July 24, 1922.

Units, Measurements and Instruments

Influence of the Conductivity of Water Upon the "Wet-Flash-Over" of Insulators.—W. WEIKER.—To determine the wet breakdown strength of insulators, water from city mains is used generally. The author shows that very great variations exist in the electrical conductivity of the water in different localities and that the results obtained will vary considerably. City water from twenty German cities has been measured as to its specific conductivity, and it was found to vary from 80 microhms to 1,010 microhms per cubic centimeter. To show the effect of differently conducting water upon the flashover, a pin-type insulator and two chains of suspension insulators were tested under a spray of the various water supplies and with rainwater. Very large differences were found, and it is recommended that mention be made in all "wet ratings" of insulators of conductivity of water used.—*Elektrische Kraftbetriebe und Bahnen*, July 10, 1922.

Indicating Wave Meter.—E. KOHLHAUER.—A direct-indicating wave meter is described for currents between 200 amp. and 700 amp. The instruments are adjusted to measure wave lengths of from 1,500 m. to 30,000 m.—*Elektrotechnische Zeitschrift*, Aug. 3, 1922.

Electrical and Magnetic Weld Testing.—T. SPOONER and I. F. KINNARD.—Laboratory tests to determine the possibility of applying electrical and magnetic methods for testing the quality of butt-welded steel plates were carried out, and the conclusion seems to be that such tests will pick out faults in the weld irrespective of what type they may be. The method of testing consisted in measuring the electrical and magnetic potential drop across the weld with a definite emf. or magnetic potential applied on opposite sides. This drop was compared with the drop over an equal length of unwelded plate.—*Iron Age*, July 20, 1922.

Illumination

Lighting of Small Stores.—A. L. POWELL.—In order to obtain information on the present practice in small-store lighting, approximately 600 typical stores of this class were inspected. Data were obtained on the dimensions, height of lamps, size and number of lamps, etc., and with the aid of the foot-candle meter, minimum, maximum and average values of illumination were obtained, some of which are given in the accompanying table. Typical layouts for various kinds and sizes of small stores are shown, together with numerous illustrations. The subject of lighting show windows is discussed and mention made of the effects obtained

AVERAGES OF INTENSITIES IN VARIOUS CLASSES OF STORES FOLLOW FAIRLY CLOSELY THE RECOMMENDED VALUES

	No. Inspected	Watts per Square Foot			Average Foot Candles			Type of Equipment			
		Minimum	Maximum	Average	Minimum	Maximum	Average	Inclosing	Semi-Indirect	Bowl Reflector	Other Forms
Bakery	14	0.3	1.3	0.85	2.5	7.5	5.7	10	3	1	..
Barber shop	30	0.7	2.5	1.5	2.5	10.0	6.5	26	3	1	..
Cigar store	20	0.8	4.4	1.6	3.5	11.0	7.1	8	..	12	..
Clothing	37	0.6	2.5	1.2	3.5	9.0	6.0	34	2	1	..
Confectionery	38	0.5	2.3	1.1	3.0	12.0	5.3	24	5	7	2
Delicatessen	40	0.5	2.5	1.1	3.0	11.0	5.7	34	1	4	1
Drug	41	0.3	1.5	1.0	2.0	11.0	6.0	25	5	11	..
Dry goods	19	0.4	2.5	1.1	3.0	10.0	5.3	14	1	4	..
Florist	19	0.5	4.0	1.2	2.0	8.0	5.0	12	4	1	2
Furniture and carpet	9	0.7	2.0	1.0	3.0	7.5	5.4	6	..	2	1
Grocery	35	0.2	2.0	1.0	2.0	10.0	5.1	20	2	12	1
Haberdashery	35	0.7	2.5	1.5	4.5	13.0	7.0	23	1	7	2
Hardware	27	0.3	2.3	1.0	3.0	9.0	5.0	16	1	8	2
Jewelry	14	0.9	2.2	1.3	3.5	10.0	6.4	7	1	6	..
Meat market	25	0.5	2.2	0.9	3.0	9.0	5.2	23	1	1	..
Millinery	32	0.5	3.3	1.3	3.5	10.0	6.6	21	4	6	1
Music	22	0.5	2.6	1.2	3.0	12.0	5.3	16	4	2	..
Restaurant	37	0.3	1.8	0.9	2.0	8.0	5.1	32	2	3	..
Shoe	36	0.6	2.8	1.2	3.5	11.0	5.8	21	7	6	2
Stationery	39	0.3	1.7	0.9	1.0	8.0	4.3	22	6	11	..
Women's wear	34	0.6	2.6	1.2	3.5	10.0	6.0	25	8	1	..

through the use of colored lights and spotlights.—*Bulletin L. D. 139 of Edison Lamp Works, General Electric Company.*

Motors and Control

Large Electric Tower Clock. — R. BÜGLER.—Description of a novel drive for a very large clock, 140 ft. above the ground, the hands of which are 9½ ft. and 6 ft. long respectively, sweeping over a dial 20 ft. in diameter. The hands, which are made of steel, contain a number of electric lamps to illuminate them uniformly. For the twelve numerals of the clock circular holes 2 ft. in diameter are provided in the face of the clock, in each of which is placed a nest of electric lamps. The four sides of the square tower carry each one clock, which is driven individually. The driving mechanism is remarkably simple, the entire work consisting of a 125-watt motor, four shafts and seven gear wheels. A master clock placed somewhere in the tower closes every minute a contact for a time interval just long enough to operate the small motor of the tower clock for such a time as to move the hands forward one-sixtieth of the dial circumference. A second motor is provided in case the first fails.—*Siemens Zeitschrift*, July, 1922.

Effect of Saturation of Magnetic Leakage Path on the Circle Diagram of the Three-Phase Induction Motor.—J. T. TAKEUCHI.—Former investigations on the saturation of the magnetic leakage path and the manner in which it affects the circle diagram have only given the results of experiments and give no idea of how to correct the circle diagram for this effect. The author explains a new idea along this line.—*Journal of Institute of Electrical Engineers of Japan*, July, 1922.

Cutting Out Coils in Direct-Current Windings.—A. C. ROE.—Speedy repairs are sometimes possible by cutting out defective coils in a direct-current motor or generator. The methods of where and how to open the coils and how to put on jumpers from one commutator bar to another are explained.—*Industrial Engineer*, August, 1922.

Protecting Alternating-Current Motors.—B. W. JONES.—The problem of properly protecting alternating-current motors against open phase, reverse phase and overloads is outlined and equipment to give this protection described.—*Power*, Aug. 22, 1922.

Heat Applications and Material Handling

Use and Abuse of Electric Arc Welding in Locomotive Work.—C. W. ROBERTS.—In all processes of autogenous welding there is an intense local heating that is unavoidable and in cooling there is liable to be a certain quantity of locked-up stresses. The question the author raises is whether these stresses are great enough and so menacing as to warrant the discontinuance of a large amount of welding. Various locomotive parts have been electrically welded and after a time have failed. Similar parts that have never been welded have also failed. An investigation of these failures is carried out for the purpose of finding whether the failure was caused by locked-up stresses, fatigued metal, faulty or inferior castings and forgings, or by an inefficient and careless welder or supervisor. Much emphasis is placed on the proper preparations before welding any job. — *Journal of American Welding Society*, July, 1922.

Manufacture of Phosphoric Acid in the Electric Furnace. — THEODORE SWANN.—The commercial production of phosphoric acid in the electric furnace by condensation and electrical precipitation is now being successfully conducted. Methods of purification have been worked out and are in operation.—*Journal of Industrial and Engineering Chemistry*, July, 1922.

Acid Electric Furnace Practice.—C. W. FRANCIS.—Basic scrap and how to charge it, methods of making a new bottom, when to tap and how to pour and alloy additions in the furnace are the main considerations in this article.—*Iron Age*, Aug. 10, 1922.

Electrophysics, Electrochemistry and Batteries

Electric Dust Precipitation.—J. KÖRTING.—The author gives a history of the development of the Cottrell precipitation process, describes the equipment of modern plants and compares the American and European practices. The tube type as well as the plate type precipitator is considered, and the necessary mechanical and electrical data are given for both. The average current requirement for a precipitator may be estimated to about ½ milliampere per one meter of high-voltage wire, or about 20 watts per meter.—*Zeitschrift des Vereines Deutscher Ingenieure*, July 22, 1922.

Engineering Problems Involving Atmospheric Moisture.—W. H. CARRIER.—The principal problems relating to atmospheric moisture that are encountered by the engineer are (a) removal of moisture from materials by drying, (b) cooling of water and of materials containing water by evaporation, (c) cooling of air or other gas by evaporation of moisture in it, (d) the artificial regulation of moisture content and the relative humidity of air for industrial purposes and for ventilation, (e) the control of moisture content of hygroscopic materials, and (f) the control of chemical reactions. These problems and their practical application to various industries are discussed in detail.—*Bulletin of the School of Engineering, Johns Hopkins University.*

Traction

An Analysis of Regenerative Braking on Electric Locomotives.—C. E. FAIRBURN and M. A. HARPER.—Characteristics and curves for considering the performance of direct-current electric locomotives are given for regenerating energy. These are calculated on the same basis as the well-known characteristic curves for motors and show the horsepower, the tractive effort, speed and efficiency plotted against the current output. — *Electric Journal* (England), July, 1922.

Telegraphy, Telephony, Radio and Signals

Fundamental Principles of Radio Telephony.—L. W. CHUBB.—As it is the universal experience that an electrical engineer is considered by his friends to be an authority on all electrical matters regardless of how divergent they may be from his particular line of work, this article on the fundamental principles of radio telephony is written with the purpose of broadening knowledge. It covers the theory of wireless waves, methods of tuning, principles of transmitting and receiving circuits for telephony, the part played by detectors and applications of vacuum tubes.—*Electric Journal*, July, 1922.

Short Electric Waves Obtained by Valves.—E. W. B. GILL and J. H. MORRELL.—Various methods have been recently discovered for the generation of continuous oscillations of short wave lengths by means of three electrode valves. The authors do not think that any special assumptions are necessary to give an explanation of the way in which the oscillations are sustained and hold that the ordinary conditions for the maintenance of oscillations by continuous emission will account for all the facts that have been observed. Only oscillations of the Barkhausen type are considered in detail, but the theory can be extended to cover all the types.—*Philosophical Magazine*, July, 1922.

Performance of a Radio-Telegraphic Transmitter.—N. LEA.—The paper deals with the performance of a commercial type of spark transmitter, and experimental results are given which enable a complete analysis of the losses to be arrived at. Particulars of the performance of this type of installation under traffic conditions show that the type of signal emitted shows high commercial efficiency.—*Electrician*, Aug. 11, 1922.

Miscellaneous

Shipping of Very Large Transformers.—E. KLEIN.—The paper describes a railway car which permits a safe shipment of a completely assembled transformer with a capacity as high as 100,000 kva. The new car consists of two five-axle trucks over which are placed two huge girders, between which the transformer is suspended. To stand the stress of this suspension, the tank walls of the transformer have to be properly reinforced. This construction will permit distributing the weight of the transformer and the car so as not to exceed 16 tons per car axle.—*Elektrotechnische Zeitshrift*, July 22, 1922.

Storing and Clarifying Oil.—Where oil reclamation is practiced the use of standard separating machines of the centrifugal type seems to be almost universal. For cleansing and purifying, the oil is led from the separating machines to reservoirs, filters and clarifying apparatus in turn. New oil is added in some cases to maintain the standard necessary for good work. Sterilizing and clarifying oils may eliminate skin affections which are common in many shops.—*American Machinist*, July 27, 1922.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

N.E.L.A. Convention Fixed

New York Chosen for the 1923 Meeting and Arrangements Made for Public Policy Meeting

AT THE session of the executive committee of the National Electric Light Association held in New York on Wednesday it was decided, on the recommendation of the committee headed by Arthur Williams, to hold the next convention in New York City. The New York Chamber of Commerce and other business organizations also urged favorable consideration of New York as the next convention city.

Headquarters will be established at the Commodore Hotel, where all meetings, with the exception of the public policy meeting, will be held. It is the expectation to stage the public policy meeting either in Carnegie Hall, the Metropolitan Opera House or some suitable theater. The date for the convention has been tentatively fixed as the week beginning June 4, 1923.

At the same executive committee meeting budgets of the headquarters staff and geographic sections were passed and approved.

New Resolution Before House on Muscle Shoals

Representative Hull of Iowa introduced in the House of Representatives on Wednesday a resolution authorizing the Secretary of War to sell to the Alabama Power Company the government-owned steam plant and substation at Gorgas and the transmission line to Sheffield, together with the substation and its appurtenances at the latter place, for a sum not less than $3,000,000. Provision is also made for the completion of Dams No. 2 and No. 3 by the government and for the leasing of them and also of the nitrate plants for a period of fifty years.

Congressman Hull says his resolution is designed to find a solution for the vexed problems that confront the government at the nitrate and power plants on the Tennessee River. Under it the Alabama Power Company, Henry Ford or any other person or organization may contract for the entire properties. The Gorgas plant, however, would be returned to the Alabama Power Company, which, Mr. Hull contends, is entitled to it provided the utility pays a fair price. This he places at not less than $3,000,000.

Active support for the completion of the Muscle Shoals power project is being given by the American Mining Congress, which will hold a convention at Chattanooga, Tenn., on Sept. 29 for the purpose of organizing a Southern division of the organization. The governors of the Southern States, mining operators and others have been invited to assist in the movement, which, it is claimed, will result in the creation of a great Southern "mineral empire."

Production of Soft Coal Now 9,500,000 Tons a Week

The Interstate Commerce Commission has issued a service order increasing the list of articles entitled to priority shipments. It includes all coal shipments in that class. Use of open-top cars for commodities other than fuel is permitted only when their destination is in the direction in which the cars are destined for coal loading.

"The production of bituminous coal," the commission said, in announcing its action, "has increased to approximately 9,500,000 tons a week and should, with reasonable use, take care of current needs, if new storage and waste of fuel and equipment are carefully avoided. The commission, therefore, feels that it can now relax its previous order."

Approval by both House and Senate of the conference report on the bill intended to prevent profiteering in coal and providing for the control of distribution has sent the measure to the President for signature. Only twelve votes were cast against it in the Senate, despite the vigorous opposition of Senators Underwood and Sutherland.

Appleton, Wis., to Celebrate Electrical Anniversary

Appleton, Wis., which, as told in the *Electrical World* for Sept. 16, page 628, has the distinction of having started the first hydro-electric incandescent lighting plant and the second electric central station in the country, will celebrate the fortieth anniversary of that event on Saturday, Sept. 30, under the auspices of the Wisconsin Utilities Association. A tablet is to be erected at one of the older paper mills where electric power was first applied, the association being joined by state engineering bodies in defraying its cost. A temporary wooden memorial will be put up on Sept. 30 and replaced by a permanent metal tablet later. A. K. Ellis, general manager of the Wisconsin Traction, Light, Heat & Power Company, and A. C. Langstadt, one of the original operators of the first plant, are to assist in preparations for the dedication.

Murray Answers Beck

Acknowledges Four Errors Which in No Way Change His Fundamental Conclusions

W. S. MURRAY of the firm of Murray & Flood, consulting engineers of New York City, has replied to the statements of Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, contained in the pamphlet "Refutation of Unjust Statements Contained in a Report Published by the National Electric Light Association," etc., published by the Hydro-Electric commission. The main contentions of Sir Adam were given in outline in the *Electrical World* for Aug. 19, page 389.

Mr. Murray acknowledges four errors in his report, which he maintains are inconsequential in character and in no way disturb or change the fundamental conclusions. He complains of the prevalence of abuse in place of argument in Sir Adam's reply, stating that "the standard practice employed by those in charge of the municipal or governmental operations is easily recognized in the reply, first, by the employment of abusive language and an attempt to challenge my personal integrity and professional standing, and, second, in his expression of the absolute infallibility of the Hydro-Electric Power Commission." Municipal operators, Mr. Murray maintains, have never been known to tolerate the light of searching analysis.

The Errors Acknowledged

In transcribing one of the seventy-one laws as prescribed under the Hydro-Electric Power Commission acts, Mr. Murray admits that the exact words of that law were not used. Its intent, however, he maintains was not changed, and in checking he failed to catch the error in transcription.

With reference to the issuance of fiats permitting suit to be brought against the commission, Mr. Murray has this to say: "Our interview with many of the officials of the commission and people of prominence in Ontario left the impression that no fiats had ever been granted. This impression was confirmed by the fact that one was not granted in the important case brought against the Hydro-Electric Power Commission by the Electrical Development Company. Sir Adam Beck replies that more than twenty-four have been granted. It would be of interest to develop of what importance they were. They at least were not of sufficient importance to have been brought to my

attention. When discussing the fiat which was not granted in the case of the Electrical Development Company, Mr. Clarkson, the public accountant for the Hydro-Electric Power Commission, made no mention of those that had been granted.

"By far, however, the most important aspect of the fiat situation is not whether they are or are not granted, but the fact that a fiat must be obtained before suit can be brought against the commission. Why should such discrimination be made in favor of the Hydro-Electric Power Commission? Why should not the commission be open to suit the same as a person or corporation? It is enough to dwell upon the weak and unsatisfactory answer offered in the so-called 'refutation,' which reads 'simply to avoid litigation of an unnecessary and vexatious nature,' and then visualize the uncontrolled and unfair position the commission possesses over the people."

Buffalo and Toronto Street-Lighting Costs

In the case of the comparison between street lighting for Buffalo and Toronto, Mr. Murray admits that he omitted to refer to the fact that Buffalo is partly lighted by gas. An inadvertent injustice was thereby done to Toronto. Mr. Murray says, however, that, not content with pointing to the fact, the Hydro commission "then proceeds to fabricate a most remarkable tabulation which purports to prove that electric power in Buffalo is 35 per cent more costly than that in Toronto. In this table 1919 rates are confused with 1920 rates and kilowatt-hours used in Toronto are transferred indiscriminately to Buffalo and vice versa."

Cost of Power Delivered

In the Murray and Flood report the capital investment in the Chippawa plant (550,000 hp.) and the Ontario Power Company is given as $97,757,614. In calculating the total production costs at Niagara Falls upon the basis of General Taylor's recommendation the annual interest (5.75 per cent) on the Chippawa development was charged out on $97,757,614 instead of on $69,000,000. According to Mr. Murray, this mechanical error can be quickly detected and is acknowledged. He says, however, that it is important to point out that on Dec. 14 Sir Adam Beck asserted, as stated in the Murray and Flood report, that the costs of the Chippawa development would be in the neighborhood of $60,000,000, while two months prior to that time Sir Adam had officially told Premier Drury that they would be more than $65,000,000. "Consequently," said Mr. Murray, "our production costs, through this error of statement on his part, were low in the amount of the additional annual interest and other fixed charges on the sum of $5,000,000. Deducting, therefore, the annual fixed charges on the Ontario plant, the resulting and correct charge for the power delivered to the municipalities is $28.55 instead of $31.70 per horsepower-year."

Many Topics at Glenwood Springs

Development in Lighting and Other Lines of Business, Security Issues, Rates and Newspaper Publicity Among Them—Local Electrical Activity Urged

DESPITE a more or less general feeling of business depression all over agricultural Colorado, the joint convention of the Colorado Electric Light, Power and Railway Association and the Rocky Mountain Geographic Division of the National Electric Light Association was one of the most successful and well-attended utility meetings ever held in the Rocky Mountain region. That this was so was the emphatic statement of the honorary life vice-president, S. E. Doane of New York, who has attended all of the nineteen conventions of the Colorado association. This was the third convention of the Rocky Mountain N. E. L. A. Division. The number of those in attendance was 115.

Sound business development, with particular attention to illumination, was the principal topic at the convention, though other subjects, such as taxation, the banker and the editor in their relation to public utilities, adequate rates and the better use of budgeting received attention. President Fred Norcross of Greeley, Col., said that the problem of the correct financing of rural extensions and the proper method of charging for service on them is the most important single problem now facing Rocky Mountain central-station companies. He urged more thought and co-operation in reaching an adequate answer to this most perplexing and yet important problem.

F. E. Hazard, Conlon Electric Washer Company, Cicero, Ill., urged central-station men to advertise their service on the basis of the benefits to be derived by the public rather than with an eye to the kilowatt-hour. He said the average central-station man cannot see the public over the top of the power house. The customer does not buy electrical energy or even electric service, but rather is willing to pay for that service to gain the benefits derived from its use. In the case of labor-saving appliances these include more leisure, better health, lengthened life and so forth.

S. E. Doane, speaking for H. A. Lane of the Joint Committee for Electrical Development, outlined the committee's program and told how local effort had been decided on as the way to handle the work. Mr. Doane also discussed practical ways and means to improve lighting business, giving many examples to prove that actual demonstration of illumination effects was the only real way to sell illumination and build a better lighting load. Each central station, he said, can find some scheme of demonstration to fit its particular needs.

P. L. Thompson, Western Electric Company, New York, developed the philosophy of and necessity for building public confidence. Examples of goodwill advertising served to give concrete inspiration to those present. W. S. Scott, East Pittsburgh, Pa., showed the advantage of industrial heating load to the central station, giving examples and statistics and dwelling on some of the technical questions involved.

W. D'Arcy Ryan, Schenectady, N. Y., showed the field for artistic outdoor illumination, giving an extensive lantern slide demonstration.

The Banker and the Utility

There is a very close community of interest between the banker and the utility man, said Frank J. Denison, vice-president Hamilton National Bank of Denver. The responsibility for the soundness of the security rests with the public utility, however. Especially in these days of the small purchaser and the extension of customer ownership, when the uninitiated public does not scrutinize too closely, does responsibility devolve on the company.

J. E. Davidson, Omaha, vice-president N. E. L. A., representing the national association, told of the various phases of the association's work and urged promotion of the "Electrify America" program through local effort.

H. B. Dwight, electrical engineer of the Colorado Public Utilities Commission, challenged the central-station men to give the same attention to an adequate solution of the rate fabric problem that they give to the other factors of central-station management, such as engineering, accounting and financing. The present rates on file with the commission, he said, indicate a "feeling around" or experimenting by each company to see what can be done without disturbing the public rather than an earnest endeavor to work out substantially correct rates on any logical basis.

Budgeting as a better aid to management was discussed by O. A. Weller of Denver, and taxation, particularly the effect of proposed measures in Colorado, was the topic of R. J. Bardwell of the same city.

The Newspaper and the Utility

E. A. Bemis, president Colorado Editorial Association, told the utility men how to educate and win over editors to understand utility problems. The much-mooted question of the relation of paid advertising and newspaper editorial policy was answered by Mr. Bemis, who said that the paid advertising merely made the editor think and that the facts would speak for themselves. The editor is human and must be educated like any one else. As to the effect of newspaper advertising on the public, one year only gets attention, two to three years is not effective, but five years is sure, and after ten years of advertising it is indispensable. The newspaper is of all means of reaching the public, other than by the spoken word the best, said Mr. Bemis, because of the reader's receptive mood.

The convention paid tribute to the effective work of both the Electrical Co-operative League and the Rocky Mountain Committee on Public Utility Information.

OFFICERS ELECTED

At the business sessions the name of the state association was changed to the Colorado Utilities Association and the fiscal year of the N. E. L. A. division was changed to correspond to that of the national association. Officers of the state association were elected as follows: President, W. F. Brown, Mountain State Telephone Company, Denver, first vice-president, E. C. Stenger, receiver Denver Tramways Company; second vice-president, C. N. Stannard, Denver Gas & Electric Company.

The executive committee will comprise C. N. Stannard of Denver, C. A. Semrad of Boulder, Col.; W. F. Raber of Pueblo, Col.; J. A. Clay of Durango, Col., and Norman Read of Denver.

Officers of the Rocky Mountain Division, N. E. L. A., elected to serve until June 30, 1923, are: President, J. F. Dostal, Colorado Springs; first vice-president, D. C. McClure, Denver; second vice-president, Norman Read, Denver; treasurer, A. C. Cornell, Denver. Members-at-large of the executive committee are E. P. Bacon of Casper, Wyo.; E. A. Phinney of Golden, Col.; Arthur Prager of Albuquerque, N. M., and J. J. Cooper of Denver.

Officers elected for the year from July 1, 1923, to June 30, 1924, are: President, D. C. McClure, Denver; first vice-president, Norman Read, Denver; second vice-president, C. A. Semrad, Boulder; treasurer, A. C. Cornell, Denver. Members-at-large of the executive committee are J. F. Dostal of Colorado Springs, Col.; E. A. Phinney of Golden, Col.; Arthur Prager of Albuquerque, N. M., and E. P. Bacon of Casper, Wyo.

Atlanta Convention Is Largely Attended

Members of Southeastern Division, N. E. L. A., Discuss General and Local Problems in Technical, Commercial, Accounting and Public Relations Sessions

CELEBRATING its tenth anniversary, the Southeastern Geographic Division of the National Electric Light Association held a well attended and very successful convention at Atlanta, beginning Tuesday, Sept. 12. The subjects of public relations and of electrical development in the Southeastern territory vied with each other for the center of the stage, although other very important matters in the Accounting, Commercial and Technical Sections were also presented and had careful consideration.

Perhaps the outstanding and best-attended session, aside from the general meetings, was that of the Public Relations Section, Preston S. Arkwright of the Georgia Railway & Power Company, chairman of that section, presiding. The feature of this session was an address by W. F. Woodruff of the Atlanta *Constitution*, who spoke on relations between public utilities and newspapers. Brief remarks were also made by President Frank W. Smith, Executive Manager M. H. Aylesworth and Director of Publicity George F. Oxley of the parent body, in addition to the scheduled afternoon program, which called for a paper entitled "Publicity," by John Paul Lucas, director of publicity of the Southern Public Utilities Company, and one on the Georgia State Committee on Public Utility Information by J. L. Murphey, its chairman.

PRESIDENT CHENEY'S ADDRESS

The convention was welcomed to Atlanta by James L. Key, Mayor of the city, and C. D. Flanigen, as past-president of the Southeastern Division, responded. President D. A. Cheney, in his address, called attention to the national work on inductive co-ordination being done jointly by the N.E.L.A. and the Associated Bell Telephone Companies, stating that H. L. Wills, engineer of the Georgia Railway & Power Company, is actively participating in the work at national headquarters through the courtesy of his employers. He called attention to a seeming lack of interest on the part of a few executives of company members of the Southeastern Division in the work of the division, although employees of companies headed by those men are active in association affairs, and suggested that wherever possible subordinates should endeavor to interest their chief executives and urge upon them the necessity and advantage of personal interest.

Concerning the work of the national association, Mr. Cheney said: "We can well take pride in our great industry, which expresses itself through the association in such a splendid record of achievement and service. The work of the committees is rapidly bringing about a better understanding of our problems among our membership, while through research and study a large volume of information and data of great practical value to the industry are being collected and put into available form. Indeed, many of the national committee reports are in themselves veritable textbooks, which, being based on actual workaday conditions of operation, are proving to be acceptable and useful guides to that better practice and economy that are the aim of every central-station man worthy of his salt."

President Cheney also touched on the national good-will publicity campaign, customer ownership and water-power development. In closing he said: "Undoubtedly we of the Southeast stand today on the very threshold of an era of rapid and substantial development in every line of human activity—an era in which the electrical industry is destined to take a leading part—and the movement is unfolding before our eyes. Our industry occupies a position of peculiar opportunity, and with our opportunity goes a commensurate responsibility to measure up to the job. As we succeed or fall short, so will it be with the communities and territories we serve."

DELEGATES VISIT TALLULAH FALLS

On Tuesday afternoon there were parallel sessions of the Technical and Commercial Sections, and Tuesday evening was held the second general session, including an address by C. Murphy Candler, chairman of the Georgia Public Service Commission. An address upon the uniform classification of accounts was delivered by W. J. Meyers, and Dr. Samuel R. Benedict, chief surgeon of the Alabama Power Company, gave a talk upon the prone-pressure method of resuscitation, with demonstrations. All sessions were omitted Wednesday, delegates and guests visiting the development of the Georgia Railway & Power Company at Tallulah Falls.

The third general session on Thursday morning was addressed by President Smith and Executive Manager Aylesworth of the National Electric Light Association. The Muscle Shoals situation was explained in detail by Thomas W. Martin, president of the Alabama Power Company, and addresses on accident prevention by Harry T. Edgar, Stone & Webster, Boston, and on meters and metering practice by F. G. Vaughen, sales manager of the General Electric Company, meter department, Schenectady, were given.

Paralleling the public relations session on Thursday afternoon was the meeting of the Accounting Section, and on Friday morning the fourth and last general session was held, with reports of the officers and election of new officers, preceded by addresses on the "Power Development of the Southeast," by Charles G. Adsit, executive engineer of the Georgia Railway & Power Company; "Public Utility Financing," by H. M. Addinsell, Harris, Forbes & Company, and "Central-Station Development," by C. W. Stone, manager of the lighting department of the General Electric Company.

ELECTION OF OFFICERS

At the executive meeting the following officers were elected for the coming year: President, W. R. Sammons, Knoxville Railway & Electric Company, Knoxville, Tenn.; first vice-president, T. W. Martin, Alabama Power Company, Birmingham; second vice-president, R. L. Lindsey, Durham Traction Company, Durham, N. C.; third vice-president, Howard Hall, Western Electric Company, Atlanta; secretary, Charles A. Collier, Georgia Railway & Power Company, Atlanta. The treasurer will be appointed by the president.

The following were elected members of the executive committee: F. L. Butler, Georgia Railway & Power Company, Atlanta; E. H. Ginn, General Electric Company, Atlanta; L. L. New-

man, Birmingham Railway, Light & Power Company, Birmingham; P. A. Tillery, Carolina Power & Light Company, Raleigh, N. C.; H. B. Whiteman, Chattanooga Railway & Light Company, Chattanooga, Tenn.; Henry Coles, Westinghouse Electric & Manufacturing Company, Atlanta; T. J. Hanlin, Tampa Electric Company, Tampa, Fla.; W. R. Marshall, Southern Public Utilities Company, Charlotte, N. C., and D. A. Cheney (ex officio), Orlando Water & Light Company, Orlando, Fla.

Electric Mining Men Meet

West Virginia and Kentucky Engineers Discuss Problems of the Bituminous Fields

REPRESENTATIVES of the soft-coal industry, including manufacturers, operators and engineers, gathered in Huntington, W. Va., on Tuesday last, for the coal exposition and the convention of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers. The exposition was opened by addresses from ex-Governor Hatfield and Congressman Goodykoontz. Exhibits from more than seventy manufacturers were displayed. The technical sessions were well attended and the papers brought out good discussions.

On Tuesday the committees on checking power costs and on mine locomotive wheels and tires rendered their reports. The discussion brought out the importance of these points in securing economic coal production. Power mining is now almost universal and record systems are essential to the industry. A paper by M. A. Whiting on "Automatic Electrical Apparatus as Applied to Coal Mining," a report from the committee on underground transmission and distribution and a report from the committee on the relative merits of storage-battery, combination and conductor-cable reel-gathering locomotives followed. These reports indicated a decided trend toward using automatic hoists and substations in mining work, as well as a tendency to use more alternating-current motor equipment, and the discussion brought out a majority opinion in favor of electrically welded bonds for mine tracks.

Committees reporting Thursday were those on all-rubber insulation as compared with braid-covered cables for mine cables and on the use of cast or rolled-steel resistance grids on mine locomotives. A paper was presented by W. C. Shunk, general superintendent Stonega Coal & Coke Company, on "How Mechanical and Electrical Men Can Increase Their Usefulness."

The wireless telephone and a radio demonstration were the feature for Friday, and in addition a report was made by the committee on the proper handling and care of insulating oils. Following this came the election of officers. More abstracts of the papers and a more complete report of the convention will be given in the next issue of the *Electrical World*.

Cities Service Gets Plant in Antwerp, Belgium

The Cities Service Company has just completed arrangements for taking over the plant and facilities of the Société pour le Commerce et l'Industrie des Huiles Minerales of Antwerp, Belgium.

The plant is a complete importing station at Antwerp, consisting of tankage for lubricating oils, gasoline, kerosene, gas oil, etc., with facilities to barrel and can, also tank cars and barges for distribution to the wide trade territory supplied by the port, including Belgium, Holland, Switzerland, Alsace-Lorraine and the Rhine Valley in Germany. This will prove an important export outlet for the products of Cities Service Company oil subsidiaries. Captain Fernand Petit of Antwerp will have charge of the property.

Investment Bankers to Discuss California Power Act

The Investment Bankers' Association of America will hold its eleventh annual convention at Del Monte, Cal., Oct. 9-12. In addition to an address by Howard Beebe of Harris, Forbes & Company, president of the association, there will be numerous committee reports and discussions on municipal affairs. The California water and power act will come up for consideration on Oct. 11, at which time an address on the situation will be made by W. E. Creed, president of the Pacific Gas & Electric Company.

Tennessee Injunction Modified

The temporary injunction recently obtained by Tennessee state officials to prevent the organization of the Tennessee Electric Power Company from going into effect, on the ground that it violated the state anti-monopoly law, has been modified to permit the company to perform its corporate business until a final decree is rendered. The new company is a reorganization of the former Tennessee Railway, Light & Power Company and its subsidiaries together with the acquisition of the Chattanooga & Tennessee River Power Company.

Undeveloped Power on Hudson Put at 222,000 Hp.

According to a report of the New York State Water Commission, there is still 222,000 hp. of undeveloped power on the upper Hudson River, including its tributary, the Sacandaga. With the exception of the Niagara and St. Lawrence Rivers, the report says, the Hudson is the most important stream as regards water power in the state. Data given in the report show that 368,000 hp. on the upper Hudson is available, of which a little over one-third is now developed.

The development of this unused power depends on the construction of a system of fourteen storage reservoirs, having a total capacity of 70,000,000,000 cu.ft. Such reservoirs, with the principal ones at Sacandaga, Gooley, Piseco Lake and Schroon Falls, would cost $24,292,000.

The storage value of these reservoirs would many times exceed their cost, and they would not only increase the available water power of the Hudson, Sacandaga and Schroon Rivers, but also mitigate flood damage with its unsanitary conditions and improve navigation as well, the report states. It estimates the annual saving of coal through the proposed development at 2,000,000 tons.

Regulate Trade Societies

Governor Miller Feels that Public Is Mulcted Unless State Prevents Abuse of Power

SPEAKING at the New York State Fair Grounds at Syracuse on Sept. 14, Governor Miller denounced the action of the coal and railroad strikers in trying to force a decision in their favor through causing the public to suffer. He also threw down the gauntlet to trade associations. As touching the latter, Governor Miller spoke as follows:

"Agriculture is the basic industry of the country, upon which its prosperity largely depends, but in an age of co-operation and organization the farmer is still the individualist of former times, though directly affected, as the general public is affected, by the modern spirit of combination. Other industries are organized on a national scale through great aggregations of capital in corporate form and associations whose organization was greatly stimulated during the war. Our notions of individual liberty and of the freedom of restraint of individual initiative from state interference must be adjusted to these modern conditions.

"When there are a large number of producers in any line of industry acting independently and freely competing, the public is safe from oppression, but when any line of production is largely controlled by a single aggregation of capital or by different groups in association, the public is at the mercy of such aggregations or associations, unless the state intervenes to prevent the abuse of power, and human nature is such that unrestrained power cannot safely be left to any private group or association. The abuses incident to such associations have been revealed by legislative investigations and the power of the criminal law to prevent them has proved inadequate. In my judgment the state must either prevent such associations entirely or intervene to regulate them and to protect the public from their abuses.

"I am a firm believer in the utmost freedom of individual initiative and enterprise, but that doctrine has its limitations, and the limit of such freedom is reached when it becomes a public menace, and that menace arises whenever the production, transportation or distribution of any essential article is controlled by a few."

Triangular Power Controversy at Holyoke

A controversy has arisen in Holyoke, Mass., over the right of the Holyoke Water Power Company to sell electricity to William Skinner & Sons which this firm, by use of its own machinery, employs to light its mills. The city solicitor has served notice on the company that any use of such energy by the Skinner firm for lighting is illegal, as the company's charter permits it to sell electricity for power purposes only.

In answering the city's complaint, the company replied that all the power supplied to Skinner & Sons was being used as power, though a portion of it was used to produce a separate and independent current that operates to light the mills when the power is used. The company asserted that Skinner & Sons use the same transformers for this light that they formerly employed when buying power from the city, and that whereas the city has always maintained a higher rate for energy used for lighting than for energy used for power, it made no such distinction in respect to the energy sold to the Skinner mills, basing its charges entirely on the rate for power. The Holyoke Chamber of Commerce has appointed a committee to try to adjust the dispute, which may be carried to the Massachusetts Department of Public Utilities.

Hydro-Electric Development in Kentucky

Formation of a syndicate to construct a seven-million-dollar hydro-electric plant on Licking River, a few miles from Falmouth, Ky., has just been announced by J. V. Oldham of Falmouth, who with S. A. Techer of Indianapolis will back the project. The dam will be built in a narrow gorge and will be more than 100 ft. long and 300 ft. high. It is intended to furnish light and power to many towns and cities in central and eastern Kentucky, including Falmouth, Cynthiana, Georgetown, Lexington, Maysville, Covington, Vanceburg, Ashland, Winchester, Brooksville, Augusta and Newport, and should make Licking River navigable for 150 miles or more.

New England Power Company to Build Tie Line

Increasing interchange requirements between the systems of the New England Power Company and the Narragansett Electric Lighting Company of Providence will soon result in the construction of a 110,000-volt tie line between Lincoln, R. I. and Swansea, Mass., which will enable high-tension energy to be directly transferred between the two companies. The Massachusetts Department of Public Utilities has approved the construction of the Massachusetts section of the line, 11.4 miles in length. About 2.9 miles will be built in northern Rhode Island. The line will connect the southbound trunk lines of the New England system with the Providence-Fall River 66,000-volt tie line and will be operated at the lower voltage for the present.

The estimated cost is $196,000. At a recent hearing President H. I. Harriman of the New England Power Company stated that the line will be designed for the ultimate operation of two circuits and when forced to the maximum transmission voltage will enable about 75,000 kw. to be interchanged. At present the New England and Narragansett system, are interconnected by a 22,000-volt line via Pawtucket. This line is becoming so heavily loaded that additional facilities are imperative. The new line will be constructed with wooden poles and steel cross-arms, the poles being set sixteen per mile.

Naval Officers Take Course in Applied Engineering

Seven naval officers, post-graduate students of the United States Naval Academy, are taking a six weeks' course in applied engineering at the

NAVAL OFFICERS AT EAST PITTSBURGH

Back row, left to right—Lieuts. R. D. Tisdale, D. D. Dupre, A. C. Thomas and R. W. Bates.

Front row, left to right—Lieuts. L. R. Moore, C. A. Macgowan and J. F. Bates, Jr.

East Pittsburgh works of the Westinghouse Electric & Manufacturing Company. The course includes lectures by Westinghouse engineers, inspection of the shops and processes, visits to other large manufacturing plants and inspection of the Westinghouse-equipped battleship Colorado at the New York Shipbuilding Corporation's docks, Camden, N. J. The course is intended to give the officers a knowledge of the design, application and manufacture of naval equipment. Four of them are studying marine propulsion equipment and the other three radio development, research and manufacturing problems. The subjects of some of the lectures are "The Design of Power Generators for Marine Application," "Temperature Limits and Insulation in Large Generators," "The Design of Main Propelling Motors" and "Propelling Machinery Control Equipment."

Wisconsin Opposes St. Paul's St. Croix Project

In response to a vigorous protest by the Wisconsin Railroad Commission against the use by the city of St. Paul of the water power of the St. Croix River, which forms part of the boundary between Minnesota and Wisconsin, the Attorney-General's Department of the latter state has declared that the Minnesota city has no legal right to construct a dam in the river or exploit its power resources. The opinion sets forth that each state has complete jurisdiction over the river to the middle of the current for water-power purposes and that "concurrent jurisdiction" whereby each state has control over all of it applies only to logs and other floating objects. The opinion says that the only legal right St. Paul may have to construct a dam lies in the possibility that it may have in its possession by assignment one of the several franchises granted by the Wisconsin Legislature several years ago to individuals for the maintenance of dams in the St. Croix River.

Three applications for water-power permits on the St. Croix are pending before the Federal Power Commission—one by the Northern States Power Company of Minneapolis, another by the city of St. Paul and a third by the association of Markham, Kelsey & Draur of St. Paul. Hearings have been ordered by the commission to determine the rights of the contending parties, and the city of St. Paul has been directed to submit such evidence as it may have of its authority to make a power development partly within Wisconsin.

Radio Manufacturers Plan to Support Broadcasting

At a recent meeting of the members of the Radio Section of the Associated Manufacturers of Electrical Supplies plans were laid to stabilize the industry and prevent the confusion that resulted from improper organization last year. The committee on broadcasting, of which M. C. Mallory of the Westinghouse Electric & Manufacturing Company is chairman, recommended that the manufacturers devote a certain percentage of their sales to the support of existing broadcasting stations and establishing others. Dr. Alfred N. Goldsmith, as chairman of the standardization committee, advocated supplying the public with devices that, even though they were made by different manufacturers, would work efficiently together. This committee also recommended co-operation with the Bureau of Standards at Washington in working out standardization. A standard method of testing receivers of the crystal type was covered in the report.

The matter of radio shows was left to the publicity committee, of which R. F. Yates is chairman. The committee on aural devices, headed by Daniel Murdock, recommended concerted action on the part of the manufacturers.

Hoover on Coal Mining

Points to a Few Lines Along Which the Projected National Coal Commission May Work

IN AN address prepared for the Salesmen's Association of the American Chemical Industry, which met last week in New York, Herbert Hoover, Secretary of Commerce, made an analysis of the conditions in the coal industry and a plea for its stabilization. Among other things, he said:

"The favorable progress of legislation for the creation of a national coal commission fully empowered to get to the bottom of the troubles in this industry is the first step in one of the most vital problems we have. I have been earnestly recommending such a commission for the last three years, because I do not believe great solutions will arise out of emotional denunciation, but out of sober scientific examination.

"There is much in the industry that needs public ventilation, but more important than this, there are two distinct lines of problems for which constructive solutions are needed that can only be furnished after more considered investigation. The first of these problems is the employer-employee relationship; the second is economic reorganization of the industry.

SOME PROPOSED REMEDIES

"There are 2,500 too many bituminous mines and 200,000 too many people in the business. This waste of labor, of capital and of coal levies tremendous tribute on the entire country. Investment in the industry is extremely speculative. Distribution costs are excessive. The operators vibrate between bankruptcy and high profits, and the public in ordinary times is paying far more for its coal than would be necessary from a stabilized industry.

"The perpetual labor difficulties are but one of the inevitable byproducts of this poor organization. Labor is struggling on one side to set up remuneration based on such day's pay and such piecework rates as will give a standard of living with 60 per cent of time employed. Labor is thus honeycombed with the worst of stimulants to unrest, insecurity of employment. At the same time, men who have the opportunity to work full time in regularly operating mines earn returns far above the average income of our most prosperous farmers and other workers. There can be no solution either for the operators or for the workers as long as this condition continues.

"Aside from relief from national stoppage in production from strikes and lockouts, there are proposals of constructive and practical remedies which should be investigated and which do not lead to socialism and destruction of American freedom and initiative. For instance, an extra annual storage of 20 per cent of railway consumption would equalize the seasonal fluctuation. Larger storage is possible by the railways at those times when public demand for coal is slack, instead of competition by the railways themselves with the public for coal, and thus for the use of cars, at the annual period of car shortage. A system of car distribution that would not itself break into regular operation would help. Larger storage by public utilities would assist and would give greater security to the public.

"A contributing remedy that will need the most earnest consideration is the possibility of permitting the cooperative system of marketing developed by the farmers to be applied by such mines as wish to adopt it, under circumstances that would assure competitive conditions. Such an arrangement would decrease distribution costs, would give more regular flow to orders, would get better car distribution, would decrease transportation, would enable the laying down of coal in storage at points of consumption, and would consequently give more regular operation with reduced working costs. More accurate statistics of capacity, production, consumption stocks and prices would greatly promote stability and would be in the true interest of the operators, who are now blamed for much that is not their fault."

Fall Meeting of American Welding Society

On Oct. 2 to Oct. 5 the American Welding Society will hold its fall meeting in Chicago. There will be committee reports on specifications for steel to be welded, electric arc welding, gas welding, properties of cast iron affecting its weldability, training of operatives, welded rail joints and other subjects. Papers announced are as follows: "Electric Arc Welding of Cast Iron," William Namack; "American Welding Society and Need for Research and Standardization," C. A. McCune; "American Bureau of Welding and Organized Research," William Spraragen; "Welded Rail-Joint Problems," E. M. T. Ryder, and "Applications of Welding in the Electric Railway Shops," J. S. McWhirter. There will be a joint meeting with the American Electric Railway Association on Oct. 4, at which the papers just named will be presented.

A. E. R. A. to Meet in Chicago on Oct. 2 to Oct. 6

The American Electric Railway Association will hold its annual convention on the Municipal Pier, Chicago, on Monday to Friday, Oct. 2 to Oct. 6. Among addresses by prominent public officials will be one on taxation of public utilities and one by Carl D. Jackson, chairman of the Wisconsin Railroad Commission. As usual, there will be abundant and comprehensive committee reports, including those on the National Electrical Safety Code, automatic substations, power distribution, lightning protection, pole reclamation and preservation, aluminum wire and one concerning the work of the Joint Committee of National Utility Associations. Edwin D. Dreyfus, engineer West Penn Railways, will present a paper on "The Related Function of Engineer and Accountant in Public Utility Development"; Walter H. Timm, New Hampshire Public Service Commission, one on "Public Utility Accounting," and Harry A. Snow, Detroit Edison Company, one on "Budget Control." A joint session with the American Welding Society will be held on Oct. 4, as announced above.

Brief News Notes

West Tulsa Plant to Be Doubled.—An addition to the West Tulsa plant of the Oklahoma Power Company that will double its present capacity, bringing it up to 20,000 kw., is to be built this fall at a cost of about $750,000.

Fire Prevention Week.—The National Fire Protection Association has planned for a wider celebration than ever before of Fire Prevention Week, which this year will be observed in the United States and Canada from Oct. 2 to Oct. 9. The national, state and municipal governments are expected to cooperate, as in former years.

Scientific Journal of Instruments.—Word comes from the Institute of Physics, 10 Essex Street, Strand, London, that it is about to issue a new monthly magazine devoted to the principles, construction and use of scientific instruments. It will be produced with the co-operation of the National Physical Laboratory. Leading British physicists are on the advisory committee.

Logging with Electricity.—Logging with electricity, attempted in no other part of California except Butte County, is an assured success, according to the manager of the Hutchinson Lumber Company, which is testing the innovation east of Oroville, Cal. Operators of the electric engines, he asserts, are enthusastic in their praise. Not only do they simplify the work, but they speedily get ample power to where the logs are being handled.

Radio Vacuum Tube Rated at 100,000 Watts.—What is said to be the largest radio vacuum tube in the world has just been developed at the telephone laboratories of the Western Electric Company in New York. It is rated at 100,000 watts, or 200 times the power required for the usual broadcasting station of 100 miles range. The essential feature of the new tube is that the "plate" is a copper cylinder forming the outer wall of the tube, which makes it possible to cool the tube by water. Difficulty was found in making the instrument air-tight and in getting the wires for the filament and grid into the tube while keeping then insulated against 20,000 volts. W. G. Housekeeper, a Western Electric engineer, discovered a way to seal copper to

glass, making an air-tight joint that will not crack at any ordinary working temperature. One of these tubes stands 3 ft. high and is 3½ in. in diameter at the bottom.

Electrical Power Gains in Tennessee.—According to the report of the Tennessee Public Service Bureau, there has been an extensive resumption of industrial activity in that state and the consumption of electrical energy has increased greatly. The survey of the board shows that the power load has made a 34.4 per cent gain in Nashville, a 47 per cent gain in Knoxville and a 33.6 per cent gain in Chattanooga over similar periods of 1921.

Electricity Making Progress in Poland.—Two large hydro-electric power plants are now under construction in Poland. One of them will produce 10,000,000 kw.-hr. a year, the other one 20,800,000 kw.-hr. At the present time the entire output of all the electric plants in the country is about 242,000 kw. and the energy generated about 370,000,000 kw.-hr. Electrification of the entire oil-well industry of the country is contemplated.

French Government Installs Radio Weather Service.—A nation-wide system of informing farmers of approaching weather conditions is being installed in France, according to a recent report to the United States Department of Agriculture. Thrice daily forecasts of the probable atmospheric changes and weather variations for the ensuing eighteen hours will be broadcast from the Eiffel Tower to agricultural districts. The service will serve communes within a radius of 300 miles from the tower.

To Improve Buffalo's Lighting System.—Plans to make Buffalo the "best lighted city in America" are being considered by the advertising group of the local Chamber of Commerce. First efforts along this line will be devoted to the downtown district. Every firm in and near Main Street will be asked to co-operate in making the city's principal thoroughfare a second "great white way." What will be particularly sought is attractive illumination, rather than glaring signs of an unartistic and perhaps offensive nature.

Utah Agricultural College Has Unusual Function.—The Attorney-General of Utah has just made a ruling on whether the board of trustees of the Utah Agricultural College has authority to prescribe the amount of electric power that the different Utah state institutions can have. The state power plant is installed at the Agricultural College, and it furnishes power and light to the state industrial school, the school for the deaf and blind, the University of Utah, including the state normal school, and the state prison. It also furnishes the state armory at Ogden and the Capitol from surplus electrical energy. The Attorney-General finds that the board of trustees may prescribe the amount of power that the different state institutions can have "if there is not sufficient power to satisfy the needs of all the institutions."

New York Police Department Adopts Radio.—A wireless broadcasting station of the latest type has been installed at Police Headquarters in New York City, and within a few months the police boats, police inspection district headquarters and stations will be equipped with receiving sets, so that they may obtain early information on stolen automobiles and crimes and criminals. The Police Department has received the permission of the Department of Commerce to operate on a special wave length of 400 m., a band not allocated to any one else, so that there will be no interference with the station.

Kewanee Votes for Municipal Plant.—The citizens of Kewanee, Ill., having voted recently in favor of a bond issue of $125,000 with which to begin the installation of a municipal electric light plant, the Consolidated Light & Power Company, a subsidiary of the American Gas Company, has offered to sell its entire property, including electric light and power, gas and heating plants, to the municipality. H. M. Smith, manager of the company, in a letter to the Mayor and Commissioners of Kewanee, stated that since acquiring these properties in 1906 the company has spent for additions and improvements approximately $575,000 and that for the last two years an adequate return has not been earned on the investment. "The people having apparently decided to go into the utility business," said Mr. Smith, "it would seem advisable for the city to occupy the field without competition." The company's franchise expires in about two years, and Mr. Smith stated that if an acceptable new franchise cannot be obtained from the city or a sale made to it, the plants will be closed.

Cooling Trout by Electricity.—West Tennessee is not the habitat of the mountain trout nor are trout streams included in the many natural attractions, but a crystal-clear brook flowing over a rocky bed, its course interspersed with falls and with the gamest of mountain trout inhabiting its stream, is to be the prize possession of a new estate under construction by Clarence Saunders at Memphis. The stream, if not the fish, is to be "done electrically." Although Mr. Saunders is transporting a complete stream from Colorado, bringing boulders, moss, ferns and the fish, he had to reckon on the natural temperature of Memphis, which is slightly higher than that to which the trout is accustomed in Colorado. To care for this he has arranged a duplicate electrical refrigerating scheme, one system to operate in case the other is interrupted, and thus will assure his trout that they will remain as cool as in their Colorado home. Engineers are at work too on an innovation for the bathing beach to be installed on an artificial lake. They are designing giant electrically operated agitators concealed beneath the surface, which are to create an artificial surf.

Associations and Societies

American Bankers' Association.—International finance is to be a main topic of discussion at the annual meeting of this association, to be held in New York City on Oct. 2 to Oct. 6. Reginald McKenna, former Chancellor of the British Exchequer, and Thomas W. Lamont are announced to speak.

Attractive Program for Springfield A.S.M.E. Meeting.—At the New England regional meeting of the American Society of Mechanical Engineers in Springfield, Mass., Sept. 25-27, F. C. Pratt, vice-president in charge of engineering, General Electric Company, Schenectady, N. Y., will deliver the opening address on "Engineering and the Engineer." A paper on "Multiple Source of Power for Reliable Industrial-Plant Operations" will be read by R. A. Packard, superintendent of power and shops for the Ludlow (Mass.) Manufacturing Associates. Among prominent engineering representatives expected at the meeting are Dean Dexter S. Kimball of Cornell University, president of the A.S.M.E.; Prof. L. P. Breckenridge of Yale and Dr. Ira N. Hollis of Worcester Polytechnic Institute.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Illuminating Engineering Society—Swampscott, Mass., Sept. 25-28. Samuel G. Hibben, 29 West 39th Street, New York. (For program see issue of Aug. 5, page 292.)

American Institute of Mining and Metallurgical Engineers—San Francisco, Sept. 25-28. F. F. Sharpless, 29 West 39th Street, New York.

N. E. L. A. Geographic Division—Great Lakes, French Lick Springs, Ind., Sept. 27-30. (For program see issue of Aug. 19, page 393.)

Indiana Electric Light Association—French Lick Springs, Ind., Sept. 28-30. Thomas Donohue, Lafayette, Ind.

Telephone Pioneers of America—Cleveland, Sept. 29-30.

American Welding Society, Chicago, Oct. 2-5.

American Electric Railway Association—Chicago, Oct. 2-6. J. W. Welsh, 8 West 40th Street, New York.

Empire State Gas and Electric Association—Lake Placid, Oct. 5-6. C. H. B. Chapin, Grand Central Terminal Bldg., New York.

Electrical Supply Jobbers' Association, Atlantic Division—Philadelphia, Oct. 6. E. Donald Tolles, 165 Broadway, New York.

Arkansas Utilities Association—Hot Springs, Ark., Oct. 9 and 10. R. I. Brown, Little Rock Ry. & Electric Co., Little Rock.

Society of Motion Picture Engineers—Rochester, N. Y., Oct. 9-12.

Association of Edison Illuminating Companies—White Sulphur Springs, W. Va., Oct. 11-14. Preston S. Millar, 80th St. and East End Ave., New York.

National Association of Electrical Contractors and Dealers—Cincinnati, Oct. 9-14. F. Johnson, 15 West 37th St., New York.

Public Utilities Association of West Virginia—Charleston, W. Va., Oct. 20-21. A. Bliss McCrum, Charleston, W. Va.

Electric Power Club—Asheville, N. C., Oct. 30. S. N. Clarkson, 506 Laclede Gas Bldg., St. Louis.

Ontario Association of Electrical Contractors and Dealers—Toronto, Nov. 13-14. J. A. McKay, 24 Adelaide St. W., Toronto.

National Association of Railway and Utilities Commissioners—Detroit, Nov. 14. J. B. Walker, New York Transit Commission, New York.

Recent Court Decisions

Temporary Injunction Against Rate Order of Commission Upheld.—The Supreme Court of Kansas has found, in Kansas City Long Distance Telephone Company vs. Reed, that the District Court did not err in issuing a temporary injunction against a rate order made by the Public Utilities Commission, on evidence purporting to show that the rates prescribed were unjust and did not provide an adequate return on the property, and where the order was made without evidence which the company, at the request of the commission, had agreed to furnish, and without notice to the company that it would be made at that time in the absence of such evidence. (207 Pac. 763).*

Powers of Kansas Commission.—The Supreme Court of Kansas, in City of Winfield vs. Court of Industrial Relations, has found that during the time the Court of Industrial Relations was vested with the duties and functions of the Public Utilities Commission that court, and the commission prior to and subsequent to that interval, had power to set aside and change the rate for natural gas furnished to the inhabitants of the city of Winfield, notwithstanding the city's objection thereto, and notwithstanding the existence of a contract between that city and the party which supplied the natural gas, which contract had been made and promulgated by a city ordinance prior to the enactment of the public utilities law; and, whatever might be urged against the impairment of such contract by the other party thereto, the changes in the rates and service by order of the state tribunal did not, as against the city, violate the contract clause of the federal Constitution. (207 Pac. 813.)

Right of Property Owner to Obstruct Erection of Pole.—In Marx vs. Edison Electric Illuminating Company of Brooklyn the plaintiff, a woman, brought suit to recover damages for serious injuries alleged to have been inflicted upon her three years previous to the trial by workmen employed by the defendant company to erect an electric light pole in the street in front of her property. The plaintiff alleged that when she tried to obstruct the erection of the pole by placing her legs in the excavation that had been made the workmen assaulted her and finally jammed the pole down against her legs, fracturing a bone and permanently injuring her. In the trial court the judge directed a non suit. The New York Supreme Court, Appellate Division, has reversed this judgment on law and facts and ordered a new trial, on the ground that no permit to erect the pole was shown to the plaintiff on her demand and that any citizen has a right to object to unlawful interference with the public highway. (194 N. Y. S. 807.)

Finding that Overload of Electrical Energy Entered Building Does Not Raise Presumption of Negligence.—Declaring that a finding by a jury, in response to a special issue, that a fire in plaintiff's building was caused by an overload of electricity entering the building does not create a presumption of negligence on the part of the electric light company serving the building, the Court of Civil Appeals of Texas affirmed judgment for the defendant in Cecil & Company vs. Stamford Gas & Electric Company. In this case the jury answered several specific questions, one to the effect just given, another to the effect that the entrance of an overload of electricity was not due to the negligence of the defendant, a third to the effect that the fire was not caused by faulty wiring inside the building for which the company was not responsible, and a fourth to the effect that the Hamlin Light, Ice & Power Company (a codefendant) did not use the high degree of care which a person of the greatest prudence would have used. On appeal, plaintiff asserted that the second answer just quoted was contrary to the evidence. This contention the Court of Appeals did not accept. (242 S. W. 536.)

Maine Commission Over-ruled.—The Supreme Judicial Court of Maine has made rulings as follows *in re* the Caribou Water, Light & Power Company upon exceptions taken by the town of Caribou to an order of the Public Utilities Commission of the state: Where a contract was made between a public utility and a town setting certain rates in consideration of the town's surrendering claims which it had against the utility under a prior contract, an order of the commission changing the rates so established by contract was not unconstitutional as an impairment of the contract or as taking of property without due process of law; where rates established in a contract between a town and a public utility are not discriminatory within the definition of the statutes, the contract is valid until the commission shall determine that the rates are unjust and unreasonable, when they become unlawful; and where part of the consideration paid by a town to a public utility was a surrender of rights belonging to the town under a prior contract with the utility, the commission should take into consideration not only the annual payments but also the consideration paid at the inception of the contract, so as to arrive at the full sum paid for the service. In fixing rates to be paid by a town to a public utility an order of the commission that the town should repay the amount annually collected as taxes upon the property of the utility was an error, since the rates should be certain and definite and not subject to fluctuation from the acts of some body other than the commission. (117 At. 579.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Individual as Against Collective Billing.—The Wisconsin Railroad Commission has held that a rule of the Beloit Water, Gas & Electric Company requiring each tenant of a building to obtain electric service through a separate meter is not unreasonable or discriminatory, irrespective of the practice of other companies. "Undoubtedly," the commission observes, "if the owner of a building is permitted to purchase the energy used by his tenants and to sell it to them at a price not controlled by the utility company, differences in rates may result between users of similar service in the same city."

Rate Readjustment for Libby (Mont.) Company.—After the filing of a complaint by the city of Libby against the electric rates of the Libby Water & Electric Company, the Montana Public Service Commission conducted an inquiry into the fair value of the company's property and the reasonableness of its rates and rules. The commission, finding that a deficit resulted from the operations of the company, entered an order increasing the rates which were less than cost of production, eliminated discrimination existing against residence consumers, and included a readiness-to-serve charge in the power schedules to reimbuse the company for its standing investment for power consumers and to prevent saddling the cost thereof on patrons who are steady purchasers. The commission further required the company to keep its records and books in Libby, Mont., instead of in Wyoming.

Extraterritorial Service of Municipal Plant.—Complaint was made against the city of Manitowoc, Wis., for alleged refusal of service previously furnished outside the city limits. The Wisconsin Railroad Commission held that a municipal plant which has to a limited extent assumed the duties of a public utility in the surrounding rural and suburban district, but has not claimed to furnish, own or maintain any permanent distribution plant outside of the city limits, should not be required to reconstruct an electric line for service to persons outside the city after such service has been discontinued because of the tearing down of the line by the owner, who had allowed others to use it. The commission held also that this owner, who had accommodated his neighbor, without profit, had not been himself conducting a public utility and had therefore a right to discontinue at his own option the service he had been rendering. Another finding was that a charge outside the city limits 50 per cent more than the regular municipal rate was not excessive or discriminatory.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

H. H. Ganser Heads Pennsylvania Electrical Association

H. H. Ganser, who was recently elected president of the Pennsylvania Electrical Association, has been the manager of the Counties Gas & Electric

H. H. GANSER

Company, Norristown, Pa., since 1912, when the Norristown Electric Light & Power Company and the Gas Company of Montgomery County merged with thirteen other companies to form the present organization. Mr. Ganser was born in 1873 at Wilmington, Del., and followed newspaper work until 1899, when he allied himself with the Gas Company of Montgomery County as collector and meter reader. In 1901 he was advanced to the position of superintendent and one year later became manager of the Norristown Steam Heat Company. In 1904 he joined the Norristown Electric Light & Power Company as agent.

Mr. Ganser is a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society, the Engineers' Club of Philadelphia and the American Gas Association and a past-president of the Pennsylvania Gas Association.

H. W. Dennis, construction engineer of the Southern California Edison Company, will be one of the speakers on hydro-electric development at the October convention of the American Society of Civil Engineers, to be held in San Francisco.

Ottomar Hamele, chief counsel of the United States Reclamation Bureau, is in the West inspecting irrigation projects. He will, among others, inspect the Strawberry Valley irrigation project and other reclamation projects in Utah.

George E. Lewis, executive manager of the Rocky Mountain Committee on Public Utility Information, and E. P. Bacon, manager of the Natrona Power Company at Casper, Wyo., visited the principal central stations in Wyoming during the summer in the interests of organization development and improved public relations.

E. E. F. Creighton, consulting engineer of the General Electric Company, recently visited the Pacific Coast. Mr. Creighton was formerly professor of electrical engineering at Stanford University. While in California he spent some time on his large ranch in the northern part of the state before going to Vancouver to attend the Pacific Coast convention of the American Institute of Electrical Engineers.

R. A. Hart, federal drainage engineer, has just returned from a two weeks' trip through Idaho and Montana, where he visited a number of proposed drainage projects with a view to making recommendations for starting them in the immediate future. Among those which he visited was one at Preston, Idaho, and another immediately west of the Yellowstone National Park in Montana.

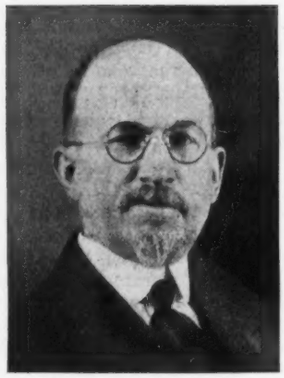
F. T. M. Kissel of the electrical division of the Public Works Department, Wellington, New Zealand, has been visiting many Pacific Coast cities recently. He is on a year's tour of the world to investigate hydro-electric development and engineering as well as the uses to which hydro-electric energy is being put. Mr. Kissel attended the recent Pacific Coast convention of the A. I. E. E. at Vancouver and plans to come east through Canada and the United States and later sail for Europe.

E. O. Shryock Made Light and Power Superintendent

E. O. Shryock, superintendent of transportation of the Columbus, Newark & Zanesville Traction Company, Zanesville, Ohio, has been selected to succeed B. S. Watters, who on Sept. 1 resigned his position as superintendent of the light and power department of the company. Mr. Shryock has a long service record in electrical utility work. In June, 1906, he was employed by the Meadville (Pa.) Traction Company, the Meadville & Cambridge Springs Street Railway and the People's Incandescent Light Company, which were jointly operated. In February, 1909, he was made superintendent of a new division then being operated under the name of the Meadville & Conneaut Lake Traction Company, holding this post until 1913, when these companies were consolidated under the name of the Northwestern Pennsylvania Railway and the Northwestern Electric Service Company. At this time he was made superintendent of transportation of the Meadville-Cambridge Springs Division, the Meadville Division and the Meadville and Conneaut Lake Division. Later the Erie Traction Company was consolidated with these companies, and Mr. Shryock was made superintendent of transportation and purchasing agent for the combined systems. In the following year he was promoted to be general superintendent, which position he held until 1920, when he resigned to become superintendent of railways of the Northwestern Ohio Railway & Power Company, with headquarters at Oak Harbor. This position he resigned in June, 1922, to become superintendent of transportation of the Columbus, Newark & Zanesville Traction Company at Zanesville.

American Society for Steel Treating Elects President

Tillman D. Lynch of the Westinghouse Electric & Manufacturing Company has recently been elected president of the American Society for Steel Treating. Mr. Lynch was born in Harrison County, W. Va., in 1867 and was graduated in 1891 from the Virginia University with the degree of civil engineer. Upon graduation, Mr. Lynch joined the contracting and inspecting engineering firm of G. W. G. Ferris & Company of Pittsburgh, Chicago and New York, doing inspection work at mill, foundry, shop and field erection. During the period from 1895 to 1897 he had charge of the Chicago office of the firm. Mr.



T. D. LYNCH

Lynch has been with the Westinghouse Electric & Manufacturing Company since 1899, holding various positions, among them being those of inspector of materials, engineer of tests, section engineer in charge of manufacturing processes and metallurgical engineer. He has written a number of technical papers for various societies and for the press.

M. L. Harned, formerly research engineer with the Union Gas & Electric Company, Cincinnati, is now engineer with Stewart & Company of that city.

A. M. Little, for twelve years president and executive head of the Mohawk Electrical Supply Company, Syracuse, N. Y., has recently been re-elected president of the organization.

Frank B. Tupper, vice-president of the Washington Coast Utilities Company, who was formerly in the Boston offices of the corporation, has been transferred to Seattle following the closing of the Boston offices.

H. J. Burgess has been engaged as electrical engineer by the H. E. Crook Company, Inc., contracting engineer, Baltimore. Mr. Burgess was formerly a member of the industrial power department of the Consolidated Gas, Electric Light & Power Company of Baltimore.

G. M. RoBards, formerly with the Apex Electric Manufacturing Company, with headquarters in Kansas City, has taken over the duties of new-business manager of the Alabama Power Company at Anniston, Ala. Mr. RoBards has had a wide experience in the commercial field.

Robert L. Eltringham, manager of the California Electrical Co-operative Campaign, recently visited Los Angeles and southern California, speaking to gatherings of electrical men and organizations on the California water and power bill. Mr. Eltringham has addressed about six thousand electrical men and reports that they are everywhere opposed to the proposed act.

Chester H. Rowell, prominent publicist and member of the California Railroad Commission, has announced his intention of resigning from the commission on Jan. 1, to spend a year or more in travel through the Orient. Commissioner Rowell was appointed in January, 1921, by Governor Stephens as successor to E. O. Edgerton, and his service has been marked by important contributions to the theory and practice of utility regulation.

E. L. Andrew, assistant manager of publicity for the Westinghouse Electric & Manufacturing Company, recently completed a tour of Western cities, during which he conferred with district sales promotion representatives and spoke before various electrical organizations. Mr. Andrew was born in the East, but went to Tacoma, Wash., while still at school. He was graduated from the University of Wisconsin with the degree of electrical engineer and then entered the Westinghouse apprentice course. After being in charge of the publicity department of the Cincinnati office for a short time, he returned to East Pittsburgh to become head of the merchandising section of the publicity department. Within a year he was intrusted with supervision of the national advertising of the company in popular magazines, newspapers and trade journals. He has initiated two comprehensive programs of co-operation between the Westinghouse company and jobbers and dealers.

C. E. Eveleth Is Assistant Manager Schenectady Works of G. E.

Charles E. Eveleth, executive engineer of the turbine department of the General Electric Company, has been appointed assistant manager of the Schenectady works of the company, the appointment dating from Sept. 1. Mr. Eveleth is a native of Toungoo, Burmah, India, where his father was a missionary, and was educated at the Worcester (Mass.) Polytechnic Institute, from which institution he was graduated in 1899 with the degree of bachelor of science in electrical engineering. In August of that year he joined the testing department of the company at the Schenectady works, of which he later became a foreman. From June, 1900, to May, 1903, he was in the switchboard department as research and experimental engineer.

C. E. EVELETH

In May, 1903, Mr. Eveleth joined the railway department as experimental and commercial engineer on submarine work, continuing in this field until the end of the war period. He joined the turbine engineering department in December, 1918, and in April, 1920, was appointed executive engineer in the Schenectady turbine department. In March of this year he was appointed to this same post in the Lynn turbine department. Mr. Eveleth became an associate member of the American Institute of Electrical Engineers in 1906.

F. J. Gleiss has resigned his position as Oakland district engineer with the Great Western Power Company, San Francisco, and is now connected with the Western Sales & Engineering Company, Oakland, Cal.

Oscar E. Halderman, who has been manager of the Elwood plant of the Indiana General Service Company, supplying light and power to Elwood, Ind., has been transferred to Muncie, Ind., where he will become manager. He had been in charge of the Elwood plant for ten years. He will be succeeded by Homer Guant, who was assistant manager of the company's plant at Marion, Ind.

Edward J. Nally, president of the Radio Corporation of America, who recently sailed for Europe on the Homeric, will visit England, France, Germany, Holland, Italy, Norway, Poland and Sweden. Mr. Nally stated that his company has concluded contracts with the governments of Poland and Sweden for the building of high-power radio stations to be used for direct duplex radiotelegraph service between these countries and the United States, thus adding two additional radio circuits to the five already in successful operation between the United States and foreign countries.

Claude E. Reese, editor of the "Gas Engineering and Appliance Catalogue" and associate editor of the *Gas Age-Record,* has joined the stoker sales department of the Westinghouse Electric & Manufacturing Company at South Philadelphia. Mr. Reese, who is a graduate gas and electrical engineer, cadet engineer and combustion engineer, has been with H. L. Doherty & Company and assistant engineer of the Illinois Public Utility Commission. He will work with G. A. Sacchi, manager of the stoker sales department, and R. R. Davis, manager of the department of publicity at East Pittsburgh.

Sidney W. Bishop, executive manager of the Denver Electrical Co-operative League, after a year as director of the affairs of the organization, has been charged with the duty of supervising its extension into those parts of Colorado and the Intermountain region which can be successfully served through the electrical industry of Denver. Mr. Bishop is a native of that city and a graduate of the University of Colorado. After his graduation he worked on a Denver newspaper, later leaving this work to enter the beet-sugar industry. Mr. Bishop joined the Denver Electrical Co-operative Campaign immediately after its inception in July, 1921.

Obituary

Frank Adam, chairman of the board of the Frank Adam Electric Company, died recently in St. Louis. Mr. Adam was a pioneer electrical goods manufacturer in that city, founding in 1890 the company which bears his name and which is best known to the trade for its extensive manufacture of switches and switchboards.

Charles G. Armstrong, an engineer and the inventor of the Armstrong signal light used in elevators, was found dead recently in his home in Jersey City. Mr. Armstrong was chief engineer of the Department of Bridges in New York City in 1912 and consulting engineer on the Singer Building. He was born in Illinois and was graduated from the University of Illinois. He was a member of several national engineering societies. Mr. Armstrong was sixty-four years old.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

More Team Play on Electric Trucks

A Frank Statement of One Obstacle Now in the Way of Prosperous Vehicle Development—Need of Better Understanding Between Manufacturers and Central Stations

By James M. Eaton
General Manager Cowan Truck Company, Holyoke, Mass.

IN THE marketing of electrical machinery of various kinds in which more than one manufacturer is concerned a greater degree of team play would be beneficial to both users and sellers. I speak of team play as co-operation between branches of the electrical industry interested in the advancement of improved methods and the proper application of modern equipment. Taking the industrial electric truck and the tractor as examples, I am convinced that much would be gained if the manufacturers of motors, control equipment, batteries and trucks would endeavor to enter into closer relations with central station companies, and if the last named, on the other hand, would meet the manufacturing contingent on the ground of a better understanding of what this class of equipment can accomplish in service, what it actually has done and along what lines it can properly be applied.

J. M. EATON

Need for Data

The application of trucks and tractors to industrial-plant service is a task in sales engineering, but in the past there has been too little realization of this. These products of reputable factories are capable of giving intensive service under widely varying conditions, and because purchasers have relied so much upon overload capacity, insufficient care in truck and tractor selection has sometimes been exercised. One of the most important bases for a co-operative advance, therefore, is the securing and interchange of more performance data among interested branches of the industry. The representatives of accessory manufacturers and of truck builders are in positions to draw forth information of great value from the field in order to help users get more out of their equipment, as well as to share with the central-station power-sales engineer well-demonstrated service data which, if properly interpreted, would go a long way toward selling the prospective customer the idea of interior electric transportation.

The value of the battery-charging load to the central-station company has often been emphasized in connection with road trucks, but less has been said about it from the industrial truck and tractor viewpoint. No truck builder, battery or motor manufacturer worthy of the name wishes to see less attention paid to the development of the domestic appliance business by central stations, but when it is realized that the output of energy required to charge a single truck of the industrial type easily may equal that demanded by 600 washing machines in a year's service, and that the big advantage is that this load is handled during the off-peak period, with off-peak characteristics as allied advantages, the importance of taking the truck and tractor seriously becomes clear.

There is a vital need of a closer understanding between central-station power-sales engineers and the various manufacturing interests represented in truck and tractor production and sales. These utility men usually have an exceptionally good entrée into local industrial plants, and if co-operation becomes more effective, much good will result.

In too many companies supplying electricity over wide areas the power sales staff at present fails to show a really active interest in truck and tractor opportunities. The manufacturers and their representatives are not well acquainted with the utility men in many cases. The former have been busy calling upon mill purchasing agents, plant engineers and other factory executives, and the central-station people frequently do not realize the field of profitable service before them in the intelligent use of trucks and tractors by the local industrial plants, large railroad terminals and stations, warehouses, etc. The percentage of "tips" or opportunities to bid on truck and tractor installations arising from central-station information is almost negligible in many localities.

Lack of Contact

It is time for a closer understanding between these branches of the electrical industry. The names of central-station power-sales engineers must be put upon the mailing and calling lists of the truck and tractor, battery, controller and accessory manufacturers, in order that the utility men may be kept in touch with the latest developments in this important field. The utility sales staffs, on the other hand, owe it to their own organizations to take an active interest in industrial electric transportation. The opportunities are too great to justify a continuance of the present drifting and indifferent policy in a potential market of such rare promise.

To Reduce the Cost of Our Product

Some Definite Suggestions to Aid the Analysis of Departmental Expenses as Factors in Manufacturing Cost

BY C. A. PORTER
Treasurer Quigley Fuel Systems, Inc.,
New York, N. Y.

ONE of the most serious questions before American manufacturers today is "How may we reduce the cost of our product?"

In order that we may get business we must be able to meet local and foreign competition. We can accomplish this only by going about the reduction of costs in a sane, careful, considerate manner. We must study our business carefully, make an exhaustive analysis of our personnel and of our expenses, of our markets for raw and finished materials and of our labor and its attitude.

Let us analyze these costs into four main groups—material, direct labor, manufacturing expense, selling expense.

Right here the average manufacturer says: "Our business is different!" We wish you to understand that the principle underlying all manufacture is the same—the requirements of raw material to be manufactured into an article to sell. It should, of course, be sold at a profit if we wish to be successful and to continue in business, but this does not mean that we can hope to make a profit on every article where sales are low.

We must next analyze the various elements of our costs, step by step; this analysis going much further than mere accounting. In the analysis of materials we must determine the materials best suited to our purposes. In times of low production it may pay to change radically from the materials used in times of high production. We may buy the materials in a different state so as to add or to cut off operations. Our source may be wrong; our handling costs per unit may not be cheap enough; our methods of warehousing may be too costly; our percentages of waste may be too high, or our utilization of byproducts may not be highly developed.

REDUCING HAND OPERATION

Direct labor must next be analyzed. We have many possibilities here, such as changing from hand to machine operations, combining and eliminating operations, changing our wage payment plans so that the unit cost per labor dollar will be reduced and still maintain a commensurate wage schedule.

Manufacturing expense, in which we will include administrative expenses, must next be analyzed. This is made up of fixed charges, or uncontrollable expenses, and controllable expenses. Fixed charges include fire insurance, capital-stock surplus tax, local-benefit taxes, building depreciation and machinery depreciation.

We may be carrying too much fire insurance; our rates may not be so low as we can get them; our fire hazards may be reduced and a new rate obtained. Our capital stock and surplus may not be correctly proportioned; our assessment for local benefits may be too high; our interest in local affairs may be only half-hearted; our building depreciation rates may be inconsistent; our equipment depreciation rates may be out of line.

CONTROLLABLE EXPENSES

Under controllable expenses we have executive salaries, office clerical salaries, shop clerical salaries, supervision, building repairs, machine repairs, liability insurance, supplies, miscellaneous expenses, welfare charges and power costs.

Our executive salaries may be out of line per person, or perhaps there may be more executives than necessary. Our office clerical salaries may be too high because we may be getting reports which are useless or at least unused and perhaps unnecessary. Our shop clerks may not be busy. Our superintendents, works manager, foremen and assistants may be more numerous than they should be. Building repairs may be too extensive or spasmodic. Machines may be repaired when they should be replaced, or repairs made in a haphazard fashion so that the work must be done over in a short time. We may not be getting the correct classifications for our labor or may be insured in the wrong company. We may not have our supplies properly safeguarded, or they may be bought on the whim of some one who is unfamiliar with the most economical needs. Miscellaneous expenses may harbor too many avoidable items. Welfare charges may be made which are unnecessary to our business under the present conditions. Our power costs may be, in many instances, substantially reduced by substituting pulverized fuel in place of the more or less antiquated system of whole-fuel combustion. By using pulverized fuel a lower grade of coal can be used in many instances; little or no banking coal is required, and a saving of 10 per cent to 50 per cent may be made.

The more usual items under selling expenses to be examined are administrative charges, sales manager's office, salesmen's salaries, salesmen's traveling expenses, commissions, advertising, return of sales, statistical information, sales clerical work, collections, discounts, entertainment, donations, rents and telephone and telegraph.

WATCH SALES EXPENSE

Administrative charges may be too heavy owing to an over-developed organization. The sales manager's office may be acquiring useless information and following up poor "prospects." Salesmen's salaries may be paid in accordance with their volume of sales, rather than their net worth to the company. Traveling expenses may not be watched so carefully as they should be, and a proper schedule of allowable expenses may possibly not be made. Perhaps commissions are being paid that are excessive for the article sold and not properly charged in the cost of selling to show the error. Advertising is a much-debated subject, but we should all remember that trade papers and almost all other magazines are in business to sell space so that we should limit our efforts to the stronger papers in each field and not spread our "shot" too much with a "sawed-off shotgun."

Our salesmen may be making rash promises to increase their sales, so that our returns and allowances are higher than they should be. Our shipping clerks may be careless in shipments so that goods are damaged or mis-sent. We may be gathering too much statistical information that is of little or no value. Our sales clerical work might possibly be cut down by co-ordination or by changing to tabulating machines. Our collections may be too slow and

our costs too high, owing to a poor credit investigation system. Our customers may be taking advantage of cash discounts on overdue payments.

Entertainment may be too large and lavish and charged to the company when it should be borne by the individual. Our donations may not be wisely given. Our rents may be higher than the class of business or the sales warrant. Our telephone and telegraph account may harbor many unnecessary or personal calls. Increased production, when plants are working below capacity, means lowered costs per unit, which is the big thing that we are striving for.

After having made a careful analysis build up a budget with all useless frills and ruffles cut from the garment—one that is in line, not with present or past production, but with a reasonable production, taking into account our own facilities, the foreign and domestic markets and our own organizations.

In order to get at *facts* along the lines of these suggestions, the executive in charge of the accounting work should take the organization chart of his company and from his intimate knowledge of inside conditions select those departments where in his opinion there is the greatest need of change or reform and study those departments.

The need for tact of the highest order cannot be too strongly emphasized. Unless the matter is handled diplomatically, too often the ends sought cannot be attained because a spirit of antagonism is immediately manifested.

Survey of Business Conditions

Switch Sales Improving

Heavy-duty switches are in increased demand, and the outlook for fall business is excellent, said C. B. Kendall of the Hart Manufacturing Company, Hartford, Conn., last week to a representative of the *Electrical World*. The company's orders from Sept. 1 to Sept. 14 exceeded the total business booked during August. Foreign trade is being well maintained and recent sales include substantial shipments to Canada, South America, England and Scandinavia. The company is operating fifty hours per week and has recently increased its productive forces.

Competition Is Keen in Algerian Market

American firms exporting electrical goods to Algeria must conform to French style and tastes and in general should follow Continental standards, says Consul Kingston in a report to the Department of Commerce. Products from the United States enjoy a very good reputation, but firms entering the market should have a representative on the ground supplied with stock. As an alternative a Paris branch could send salesmen to call regularly on the trade in Algiers, Oran and other large cities.

The chief factor in the Algerian trade is minimum price consistent with good quality. Generous and well-placed advertising is a good investment but should be prepared by some one who is familiar not only with the French language but with French tastes and mentality.

Algeria, being almost exclusively an agricultural country, is obliged to import all its electrical material and equipment. The market is largely controlled by French manufacturers, some of whom maintain factory branches in Algeria supplied with stocks and include in their organization traveling salesmen besides agents in the interior of the colony. French factories also transact business through agents working on a commission basis, usually with an allowance for advertising. The small trade is handled through local firms, the manufacturer dealing directly only in the case of large consumers and wholesalers.

Before the war Germany provided keen competition in the Algerian market, according trade facilities which the French houses were not able to meet. England has a small share of the electrical goods business of Algeria, English firms usually working through a commission agent whom they supply with a small stock of goods on consignment to enable him to fill orders readily.

No other power has any share of importance in the electrical goods trade of the country, such American products as are sold having been imported from Paris.

Italians Want American Radio

There is indication of a growing interest on the part of the Italians in American production of wireless apparatus, and inquiries are being received both for transmitting apparatus to be used in broadcasting and for radiotelephone receiving sets, according to the Department of Commerce.

Commerce Department Sells Goods Abroad by Radio

"Tipping off" American business men by radio as to foreign sales openings in order to get the jump on America's competitors for the world's markets is the Commerce Department's latest trade-promoting stunt. Inquiries for American goods coming into the Bureau of Foreign and Domestic Commerce from consuls, commercial attachés and other government representatives in foreign countries are now distributed to New England manufacturers and merchants through the air by the bureau's Boston office in collaboration with the WGI broadcasting station at Medford.

The service was tried out one night last week for the first time as an experiment. By first mail the next morning several letters were received from nearby firms. One of the leading New England manufacturers of artificial leather who happened to be "listening in" that night learned of two possible openings for his goods—one in Mexico and the other in Colombia. He was much pleased, commending the Department of Commerce for taking advantage of "this most valuable time saving device."

In the opinion of another New England merchant, the new "sell-it-by-air" service should appeal particularly to the out-of-town manufacturers and merchants who are not in daily contact with the offices maintained by the Commerce Department in Boston, New York, San Francisco, Chicago, New Orleans and other leading cities. "For example," says this executive, "there are many manufacturers interested in radio who wish to sell abroad but who are prevented from keeping in constant touch by frequent visits and telephone calls with the trade openings reported to the government agents. As the radio stations reach many outlying cities, it would seem that this service should be of especial value to more distantly situated business men within a wide radius."

Prevailing Conditions Affecting Cost and Volume

Rubber Consumption.—According to a report by an investigating committee in England, the rubber-growing countries of the world have an estimated productive capacity in 1922 of 400,000 tons of crude rubber, while the year's consumption, it is estimated, will not exceed 300,000 tons.

Loading of Bituminous Coal.—Bituminous coal loadings on Tuesday, Sept. 12, totaled 30,786 cars, according to reports just received by the Association of Railway Executives from the railroads of the country. This was a decrease of 5,022 cars compared with the preceding day, but loadings on Monday are always heavier than on other days owing to the accumulation of empty cars over the week end.

Bank Clearings.—The margin of increase in bank clearings over the fig-

ures of a year ago narrowed appreciably for the week ended Sept. 16, an aggregate of $6,221,437,000 at twenty cities in the United States, as reported to *Dun's Review*, representing a gain of 11.8 per cent over the $5,564,865,879 of the corresponding period of 1921.

Failures.—Increases in the Southern and Pacific sections were slightly larger than declines in the other two sections of the United States, so that failures reported to R. G. Dun & Company for the week ended Sept. 16 totaled 333.

Export Rates Reduced. — Railroads west of the Mississippi River have reduced export rates on certain commodity shipments from Chicago, St. Louis, St. Paul, Minneapolis, Omaha, Kansas City, Denver and related points to San Francisco and Seattle, destined to points on the west coast of Central and South America.

Factory Employment Gains in New York.—Instead of the usual reduction in employment in August, figures compiled by the New York State Department of Labor show a gain of 2 per cent last month in the number of workers employed within the state compared with July.

Volume of Business. — Volume of business for the week ended Sept. 13 was $8,233,000,000, marking an increase of $827,000,000, or about 11 per cent, over the total of $7,406,000,000 reported for the preceding week.

Decided Slump in Electrical Exports During July

A decided slump in the amount of electrical machinery and apparatus exported is shown by the July figures of the Bureau of Foreign and Domestic Commerce which have just been made public. The value of all exports during July was $4,350,128. This is nearly $2,000,000 under the June movement and is $1,000,000 less than the value of the exports in July of 1921. The detailed figures are given below.

Metal Market Situation

Foreign Business Better than Domestic —Many Manufacturers Have Not Felt Coal Improvement

Foreign copper business is better than the domestic, and sales in both quarters have been better than for some weeks past. The price of 14 cents for electrolytic copper through the remainder of the year prevails, but no one seems to be disposed to quote into 1923 as yet. There is no apparent tendency to shade or raise prices at present, and there is no spread in quotations between the large and small producers.

Those who have been predicting an advance in copper prices have been somewhat disappointed by the recent developments. Their predictions were based on expectations that the settlement of the coal strike would result in an increased demand from consumers and thus bring about an advancing tendency. However, copper users are not yet rushing into the copper market for their future heavy requirements, because they have had no trouble in the past in placing orders, and it is believed they will continue to do business on a hand-to-mouth basis until such time as circumstances force them to change their tactics.

Many manufacturing consumers of copper have not yet felt the improvement in the coal situation because their receipts of fuel have not increased to any material extent. However, they have been increasing their operations, working on their surplus supply of fuel, as they feel that they can replenish their stocks when the coal movement becomes more general and these industries to which priority has been given have been taken care of.

Some copper sellers report an increased demand for casting copper for export and insist that the gain in foreign demand for this lower grade of the metal has been larger than for the electrolytic during the past week. China has been the leading buyer, and the quotation has been 13¾ cents, free alongside ship, or equal approximately to 13⅞ cents, delivered.

Approximately 100,000,000 lb. of copper will be utilized this year in the manufacture of automobiles in this country, according to a survey just completed by the Copper and Brass Research Association. This is 30,000,000 lb. more than in 1921 and about 750,000 lb. more than in 1920, in which latter year the automobile industry consumed 7.63 per cent of the total copper production.

NEW YORK METAL MARKET PRICES

	Sept. 14, 1922 Cents per Pound	Sept. 21, 1922 Cents per Pound
Copper		
Prime Lake	14.00	14.00
Electrolytic	14.00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price	5.75	5.75
Antimony	5.25	5.25
Nickel, ingot	36.00	36.00
Zinc, spot	6.50	6.50
Tin, Straits	32.20	32.20
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	11.00–11.25	11.00–11.25
Brass, heavy	5.75– 6.25	5.75– 6.25
Brass, light	5.25– 5.50	5.25– 5.50
Lead, heavy	4.62½–4.75	4.62½–4.75
Zinc, old scrap	3.00– 3.37½	3.00– 3.37½

ELECTRICAL EXPORTS FOR JULY, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

	July, 1921 Value	July, 1922 Value
Electrical glassware, except for lighting	.....	$15,326
Electrical porcelain	.....	86,571
Carbons for electric lighting, electrodes and batteries	$29,317	99,286
Insulated wire and cable (iron and steel)	.....	16,296
Other manufactures of aluminum	116,126	79,901
Copper wire (bare)	66,823	130,184
Insulated copper wire and cable	496,928	145,186
Generators:	790,634	.....
Direct-current—		
Under 500 kw.	.....	38,671
500 kw. and over	.....	23,482
Alternating-current—		
Under 2,000 kw.	.....	35,392
2,000 kw. and over	.....	82,376
Accessories and parts of generators	.....	251,709
Self-contained lighting outfits	.....	52,571
Batteries	183,525	.....
Primary—dry	.....	70,440
Primary—wet	.....	567
Storage	.....	107,377
Transforming or converting apparatus:		
Power transformers	.....	449,132
Other transformers	.....	48,578
Rectifiers	.....	5,843
Condensers, double-current and motor generators, dynamotors, synchronous and other converters	.....	150,276
Transmission and distribution apparatus:		
Switchboards and panelboards, except telephone	.....	274,906
Switches and circuit breakers	.....	180,776
Fuses and fuse plugs	.....	14,525
Watt-hour & other measuring meters	.....	20,539
Volt, watt and ampere meters and other recording, indicating and testing apparatus	.....	84,103
Lightning arresters, choke coils, reactors and other protective devices	.....	23,988
Motors, starters and controllers:		
Motors, under 1 hp.	.....	70,944
Stationary motors—		
1 to 200 hp.	.....	172,002
Over 200 hp.	.....	$155,061
Railway motors	.....	46,746
Electric locomotives	423,176	.....
Railway	.....	.....
Mining and industrial	.....	8,802
Other motors	1,121,583	14,278
Rheostats, controllers and other starting and controlling equipment	61,755	39,346
Accessories and parts for motors	.....	97,706
Electric appliances:		
Electric fans	37,566	51,463
Electric lamps—		
Arc	.....	1,316
Incandescent—		
Carbon-filament	10,802	5,629
Metal-filament	153,689	84,769
Other electric lamps	.....	11,708
Flashlights	.....	21,240
Searchlights and projectors	.....	5,056
Motor-driven household devices	.....	34,928
Domestic heating and cooking devices	54,262	36,116
Industrial electric furnaces and ovens	.....	5,698
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	.....	42,307
Signal and communication devices:		
Radio and wireless apparatus	.....	385,861
Telegraph apparatus	.....	9,979
Telephone apparatus, including switchboards	.....	240,310
Police, fire and burglar alarm	.....	708
Railway signals, switches and attachments	.....	124,359
Bells, buzzers and annunciators	.....	5,461
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	85,173	80,446
Insulating material	.....	87,217
Metal conduit, outlet and switch boxes	.....	27,202
Sockets, outlets and receptacles	.....	34,070
Other wiring supplies and fixtures	79,327	89,738
Other electrical apparatus not elsewhere specified	1,716,498	444,404
Electrical machinery and apparatus (total)	$6,314,267	$4,350,128

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

ELECTRICAL business continues to show improvement, reports from all over the United States indicate. Central-station companies are preparing for the winter months, extending new lines and repairing the old. Poles and wire are moving better than for some time past. Lamp sales are beginning to pick up as a result of replacement buying by residential and industrial customers. Conduit stocks are lower in some sections of the United States, while in some Eastern cities sufficient material is to be found. Appliances are showing much activity. Prices generally are firm.

New York

Heater Sales Are Helped by Cooler Weather—Lamps Are Selling Best in Years

Sales of electrical materials and apparatus continue to show improvement. Stocks of conduit are more ample, recent orders of pipe having come from the mills to supply the heavy demand of fall construction. Central-station business is greater than last year, and much activity is being shown in preparation for the winter months. As a consequence of this poles and pole-line hardware are moving more actively. Lamps are reported selling better than for some years past.

Heaters.—Cooler weather has brought on brisk sales and the jobbers are easily supplying the market with styles of all kinds. Prices generally are firm.

Sockets.—Deliveries are satisfactory and stocks are meeting all requirements. Prices are firm. Sales are heavier than a year ago.

Meters.—An optimistic outlook prevails in the meter market, and sales are expected to continue strong for the rest of the year. Residential types are selling best.

Chicago

Wiring Prices Firm—Movement of Poles Improving—Better Demand for Radio Reported

A steady but firm electrical market was reported by jobbers this week. Prices on wiring materials are firm and stocks are ample on most lines except conduit. This material is still scarce, especially in the smaller sizes. Action on high-tension equipment still continues. Poles and cross-arms are gradually working out of the summer sluggishness. Radio demand is picking up and dealers feel that the winter business will be active.

Wire.—The market for rubber-covered No. 14 wire is firm, and in 5,000-ft. lots it costs between $6.20 and $6.35 per 1,000 ft. Jobbers report stocks in fair condition. No change in weatherproof or bare-wire demand.

Flexible Armored Conductor.—This material is available in the No. 14 two-wire, single-strip size for $48 per 1,000 ft. in 5,000-ft. lots. Action has been fair and stocks are normal.

Conduit.—Car scarcity is still keeping stocks of the smaller sizes of conduit down to low limits. The ½-in. black pipe is quoted at $55 and $57 per 1,000 ft. Demand is keen.

High-Tension Equipment. — Activity is still good. One manufacturer reports sales on seven 33,000-volt outdoor substations ranging from 200 kva. to 1,000 kva. to a Southwestern utility. Two 66,000-volt, 2,000-kva. substations were sent to a concern in the West.

Poles. — Movement is picking up after the summer let-up. Several ornamental street-lighting projects are calling for this equipment. Shipments from the coast are slow owing to a shortage of flat cars. Most dealers expect a good business this fall to prepare lines for the winter. Prices remain unchanged.

Cross-Arms.—This market follows the demand for poles and is steady both in price and demand.

Radio.—A slight improvement in the radio demand was noticed this week. Stocks are in good condition, and most jobbers think that the present start is indicative of an active winter's trade.

Cleveland

Heavy Stocks of Radio Reported—Refrigerating Machines Are Selling Better—Heaters Active

Electrical business continues in good volume, although nothing of great interest has occurred during the week except a slight acceleration in the sale of electric heaters and a general increase in the sale of appliances.

Radio Equipment.—Jobbers and retailers report a satisfactory week with a marked increase in the sale of parts. Heavy stocks are reported.

Refrigerating Machines. — Greater activity is reported with all indications that a fertile market is being developed. Several apartment houses under construction have ordered refrigerating equipment installed.

Heaters.—The cool weather has increased the sale of heaters appreciably. Stocks are good and prices are firm. An active fall season is expected.

Washers.—While demand has remained firm, there has been no evident increase in business over last week. Stocks and deliveries are good.

Ironers.—Sales in this line are showing good progress and stocks are ample.

Boston

Gradual Improvement Noted—Street Lighting Shows More Life—Non-employment Is Diminishing

Gradual improvement in trade is evident. Prices are firm, with tendencies to stiffen in rigid conduit. Wiring supplies are in chief demand in jobbing circles and apparatus sales are reported good among manufacturers. Deliveries have not yet got back to normal, although current needs in most lines are being met readily. Building operations continue healthy and retail trade is picking up in New England. Threatened coal shortage has led to improved sales of small or medium-sized generators for use in water-power plants, both central-station and industrial. Street lighting has shown more life, and a new installation in the Boston Back Bay district has attracted attention. Labor conditions in this district are quieter as regards strike troubles, and non-employment is diminishing.

Wire.—Rubber-covered wire is moving faster, and No. 14 sells at $6.25 per 1,000 ft. in Boston in 5,000-ft. lots. Weatherproof is dull this week, quotations being upon a 16.5-cent to 17-cent base. Little bare wire is moving.

Loom.—Sales have slowed up somewhat except for the "down East" demand. Prices have stiffened about 5 per cent recently. Stocks are ample.

Rigid Conduit.—Stocks are very much broken and shortages are reported in both large and small sizes. Quotations are tending higher. Deliveries are slow and the demand is active.

Flexible Armored Conductor. — A healthy demand is apparent on the basis of $44.20 per 1,000 ft. in 1,000-ft. lots for No. 14 single-strip. So far there is no serious shortage reported.

Motors.—Sales from week to week are somewhat spotty in small motors, but compared with last year's volume, 20 or 25 per cent better. In New England the motor business is reviving slowly but surely. Excellent deliveries are being made from the factories, and the second-hand supply from war plants has not upset conditions as much as was feared in some quarters.

Radiators.—The demand has leaped into brisk sales within a few days. The expectation is that factory stocks accumulated during the summer production period will soon be lowered to a point where deliveries will be decidedly lengthened. Prices are firm, and retail trade is beginning to improve.

Sockets.—Trade is good and deliveries are satisfactory. Prices are firm. Pulls in case lots net 32½ cents, keys 18½ cents and keyless 17 cents. Sales as a whole are much better than a year ago.

Porcelain.—Knobs and tubes are moving well, and so far deliveries are giving no serious trouble. Advance ordering, however, is playing a part in meeting current requirements.

Atlanta

Conduit Shortage Reported—Safety Switches Are Active—Good Stocks of Telephone Equipment

There has been no particular change in general conditions since last week. Jobbers report the volume of orders as very satisfactory, but on account of slow deliveries stocks are getting so low in some lines that it is difficult to fill the orders. A general shortage in conduit still exists in this section. Jobbers handling farm-lighting outfits report a quickened interest in this line, with satisfactory orders coming from North Carolina and the peach section of Georgia. An intensive advertising campaign will be launched in this line within the next few weeks which should boost sales considerably. Several large contracts have been let recently for the electrification of mechanically driven mills, and this will affect transformer and motor equipment lines.

Lamp Cord.—Temporary work is taking a satisfactory quantity of this article and jobbers have stocks on hand to meet all requirements. No recent price changes are to be noted.

Safety Switches. — Jobbers report good sales in this line with switches of from 30 amp. to 600 amp. 250-volt types, the best sellers. Satisfactory stocks are on hand.

Telephone Equipment. — The fall pick-up in this line has not yet materialized, but jobbers have good stocks on hand in anticipation of a brisker movement. No recent price changes are reported.

Electric Churns.—Only a fair movement is reported in this line, such sales as are reported being for the 32-volt type. Good stocks and steady prices seem to be the rule in the territory.

Outlet Boxes. — The demand for standard sizes is very good and jobbers have ample stocks on hand. Shipments are prompt but deliveries slow. No recent price changes reported.

Refrigerating Equipment. — Interest in this line is maintained, and dealers handling this equipment report satisfactory sales. Local advertising campaigns are on in Atlanta, and this will doubtless cause a brisker movement.

St. Louis

Demand for Residential Meters Steady —Holiday Business in Hollow Ware Has Begun

It is generally believed by jobbers that improved business will soon result from settlement of the rail strike and consequent improvement of morale. Local bankers, manufacturers and business men express relief that this major labor difficulty gives evidence of being concluded. With wheat harvest nearly completed, with a corn crop maturing that will be at least equal to the five-year average, with cotton picking now under way and its deterioration arrested by cooler temperatures, and with bumper fruit crops, purchasing power in this district will certainly be up to standard this fall and business in all lines is expected to be good.

Meters.—Demand of residential types is steady and, because of completion of extensive building programs over the entire territory, will probably continue good to the end of the year. Three-phase meters are much more active and demand should further increase because of extensive industrial construction.

Transformers.—There is a strong demand for large-sized power transformers, Kansas City and St. Louis being the principal fields. Sales of single-phase units for distribution are steady, but no large extensions by power companies are under way.

Hollow Ware.—Holiday ordering has begun on a small scale. Dealers' and jobbers' stocks have been conservatively maintained and indications are favorable to good buying.

Washing Machines.—Special efforts by jobbers have resulted in reasonably good sales which are growing in volume. Stocks are good.

Sewing Machines.—Improved demand and ample stocks are reported. Motors are dull.

San Francisco

Conduit Shortage Causing Serious Concern—Schedule Material Business Is Good

Store business is markedly better especially in smaller table appliances. Collections are slightly better.

Radio Material.—Movement is slow and still far below spring demand probably because of character of broadcasting. The present schedule is badly tangled. Dealers realize that future business depends upon improvement and standardization of broadcasting, and early action is expected.

Household Appliances. — Jobbers of standard lines are seeking new outlets for volume, recognizing the fact that electrical dealers and contractors are diverging more and more. House-to-house campaigns are not showing successful results. Business is apparently coming back to stores, therefore new favorable store outlets are being sought. Washer sales are very good, thus confirming the September prediction. Vacuum-cleaner sales are comparatively slow, but the greater volume of tools sold suggests encouraging future outlet. Other appliances, such as ironers, show little movement, though sewing-machine sales show an upper trend.

Conduit.—The situation is causing serious concern. The twin strikes, coal and rail, sharply cut into production which, coupled with record-breaking building in California, has produced a situation whose parallel existed only in summer of 1918. Only the largest sizes remain in stock. The settlement of the coal strike and the predicted early settlement of the rail strike come just in time to cause partial shipments that will tide over the worst and prevent absolute shutdown of electrical works because of pipe shortage. Eastern winter conditions, with a larger proportion of coal diverted from industries for heating, may cause a serious condition.

Schedule Material.—Volume for volume, present demand exceeds war-time demand, although higher war-time prices probably caused greater sales in dollars. Even that record may be shortly broken with constantly climbing building records. Demand is well distributed throughout a variety of devices as compared with the spasmodic and spotty war-time call.

Salt Lake City—Denver

Call for Radio Parts Especially Good—Air-Heater Stocks Are Reported Somewhat Low

Industry generally is resuming a settled trend and buying in most lines is showing a corresponding improvement. Virtually all of the railway strikers have returned to their jobs. Transportation is in better condition and perishable crops are moving satisfactorily. Millions of dollars representing Pacific Coast capital is seeking outlet in Intermountain development projects. The result is a growing optimism for future production and business. The demand for electrical merchandise shows slow but steady improvement.

Radio.—Jobbers' stocks are improving, owing to a let-up in consumer demand during summer. The market shows a better tone as summer merges into fall. The call for parts for amateur construction is especially good. Interest is said to be reviving all along the line.

Air Heaters. — Stocks are reported somewhat low. Several jobbers have cleaned up holdover stocks and placed good-sized orders. Reduction in price reaches as much as 20 per cent on some lines.

Portland—Seattle

Stocks Generally in Good Shape—Conduit Price Reduced About 5 per Cent

Business conditions continue good. Lumber production is normal, but new business continues about equal to production and back orders are very large. Car shortage is seriously hampering rail shipments. About 40 per cent of the total shipments from the Northwest are moving by water. The grain movement is in full swing and receipts are increasing daily.

Building construction continues to be active throughout the Northwest, and the value of such work started in this district during the first eight months of 1922 exceeds that for the same period of 1921 by 44 per cent, while the number of electrical permits issued maintains about the same ratio. The employment situation for this district remains about normal. Practically all lines of industries are active at the present.

Demand for harvest and fruit hands is large, a shortage of help is reported

in some districts. The section of the new tariff bill putting a tariff on cedar logs but admitting cedar shingles duty free is causing considerable alarm among Northwest shingle mills.

Electrical jobbers and contractor-dealers report business to be very good, particularly in schedule material. The effect of the fall demand for lamps is beginning to be felt. Stocks in general are in very good shape, although shortages are reported in some sections in conduit and steel boxes. Prices are generally steady. A reduction in the price of conduit is reported for this week amounting to about five per cent.

Porcelain.—The demand for knobs, cleats and tubes is active and the price has remained steady for the past several months.

Insulators.—Glass insulators remain steady in price and the demand is fair.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Federal Wireless Contract Is Taken by New Concern

The contract of the Federal Wireless Company of California for erecting wireless stations in China, which has been the focus of international negotiators for some months, has been taken over by a new concern jointly owned by the Federal Company and the Radio Corporation of America, directors of the Federal company have just recently announced.

The new company will be known as the Federal Wireless Company of Delaware and is said to have the approval of the State Department. The announcement declared that the arrangement would insure the immediate construction of high-powered radio stations in China and a new American-controlled channel of communication with that country.

Electric Power Club Is Now Established in Cleveland

The Electric Power Club has recently moved its headquarters from St. Louis to Cleveland, opening offices in the Kirby Building there. Cleveland was selected as the permanent headquarters of the club because it is the most central point for the majority of its members.

The club, which is an association of eighty-five representative manufacturers of electric power apparatus and control equipment, is organized for the standardization, improved production and increased distribution of electrical machinery and apparatus, succeeding the American Association of Electric Motor Manufacturers, which was organized in 1908.

The officers are: R. J. Russell, president; C. H. Roth, vice-president and secretary; J. K. Bass, treasurer, and S. N. Clarkson, executive secretary.

According to Executive Secretary Clarkson, the member companies manufacture more than 95 per cent of the electrical apparatus and machinery produced in this country and nearly one-third of the members are located in Ohio.

Included among the member companies are the General Electric Company, the Westinghouse Electric & Manufacturing Company, the Robbins & Myers Company, the Electric Storage Battery Company, the Van Dorn Electric Tool Company, the Otis Elevator Company and the Ohio Electric & Controller Company.

Buyer of Bankrupt Electrical Company Sues for Its Name

Suit has been started in the United States Circuit Court of Appeals at Cincinnati by the Theobald-Jansen Electric Company, Louisville, purchaser of the assets of the Harry I. Wood Electric Company, bankrupt corporation, at a referee's bankruptcy sale to establish whether it acquired with other assets the right to use the corporate name of the Harry I. Wood Electric Company.

After acquisition for $51,000 of the assets of the Wood company in the court of Judge George A. Brent, referee in bankruptcy, by the Theobald-Jansen Company, attorneys for Mr. Wood, who since has died but who then was the president and largest stockholder of the Harry I. Wood Company, brought this question of the sale of its corporate name before Judge Walter Evans, who nullified that part of the sale which included the corporate name. The case was then taken to the United States Court of Appeals at Cincinnati by the Theobald-Jansen company on a petition for review.

Lynn Works of G. E. Company Are Being Enlarged

The General Electric Company, West Lynn, Mass., will shortly begin the construction of a four-story, 122-ft. x 57-ft., brick and concrete addition to building No. 63, for turbine and compressor work, at a cost of $200,000. The building will, it is said, be the last word in modern factory construction and will give the General Electric Company more than 75,000 sq.ft. of additional floor space.

National Electrical Credits Report on Delinquencies

The accompanying tabulation shows the number of delinquent accounts reported during July and August of this year, as compared with July and August, 1921, to the National Electrical Credit Association, headquarters in Chicago, by member manufacturers and jobbers, together with the total amounts and the average amounts of the delinquencies.

Branch and Month	Number of Delinquent Accounts Reported	Total Amount	Average Amount
Central Division:			
July, 1921	617	$80,681.69	$130.77
July, 1922	727	87,643.24	120.55
August, 1921	657	101,140.35	153.94
August, 1922	773	104,433.30	135.10
New York:			
July, 1921	341	67,907.00	199.00
July, 1922	395	54,704.00	139.00
August, 1921	370	62,758.00	169.00
August, 1922	578	79,764.00	138.00
Philadelphia:			
July, 1921	220	41,116.03	186.89
July, 1922	261	23,083.53	38.44
August, 1921	246	25,332.55	102.98
August, 1922	258	37,013.70	143.46
New England:			
July, 1921	80	10,194.64	127.43
July, 1922	55	6,779.59	123.46
August, 1921	62	11,929.57	192.41
August, 1922	63	9,491.30	150.65
Pacific Coast:			
July, 1921	19	3,511.55	184.61
July, 1922	13	1,280.71	98.51
August, 1921	17	3,271.30	196.54
August, 1922	21	3,450.23	154.77

It is to be noted that in the Central and New York divisions the increases in delinquencies are large, while in the New England and Pacific Coast divisions increases are small and in some cases there are decreases in the number of delinquencies.

Westinghouse Company Receives French Railway Contract

An order covering the complete control equipment for 120 electric locomotives now under construction has been received by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., from the Paris-Orleans Railway of France as part of an electrification contract amounting to approximately $8,000,000.

The Paris-Orleans Railway, which is one of the largest systems in France, operating over 5,000 route miles of track, is electrifying 125 miles of its main line between Paris and Vierzon. This is the first of an extensive program laid out by the Paris-Orleans for the electrification of its lines.

After a careful and exhaustive study by the railway engineers of the various systems of control now on the market, they selected the Westinghouse electro-pneumatic control, which is now standard on most of the large railroads in America.

The complete order of control equipment will be manufactured in the United States, and shipment of this order will commence in January, 1923, and extend to December, 1924.

Announcement is made that the Westinghouse Electric & Manufacturing Company has become agent for the De Laval transformer-oil purifiers and dehydrators.

This make of apparatus, which operates on the centrifugal principal, is equally well adapted to the removal of sludge from lubricating oil and to the dehydration and purification of transformer and other insulating oils. Some of its distinctive features are that it is simple and effective in operation, reduces the expense of dehydration, is rugged in construction, and uses no filter medium of any kind, thus eliminating a source of delay and expense.

Elliott Company Opens Atlanta Office

The Elliott Company of Pittsburgh, with sales offices and factory at Jeannette, Pa., announces the opening of a new district sales office in Atlanta at 305 Haas-Howell Building. This move was felt necessary in order to take care of the company's increasing business in this territory and to serve more effectively the interests of customers and prospective customers in this district.

The Atlanta office makes the twelfth Elliott district sales office, all of which are located at strategic points and are manned by sales engineers especially trained for rendering service in connection with Elliott, Liberty and Lagonda products.

The new Atlanta office is in charge of H. A. Hoffmann, formerly with the Elliott Company in the Philadelphia office.

Jeannin Electric Company Moves to New Factory

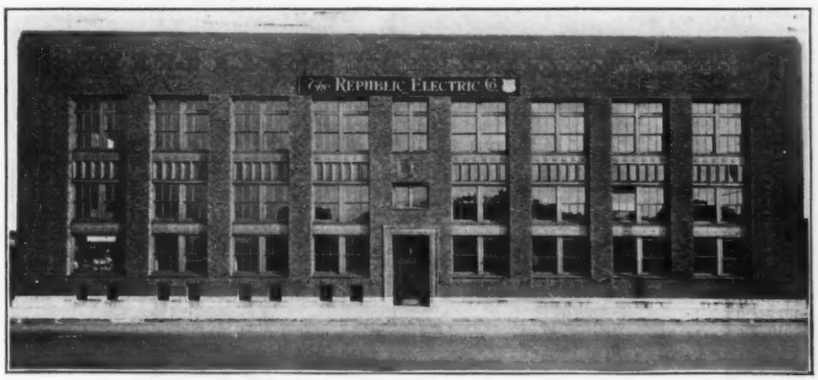
The Jeannin Electric Company, Toledo, Ohio, has recently moved into its new factory, with 10,000 sq.ft. of floor space, situated near the Baltimore & Ohio and the Wheeling & Lake Erie Railroads, Toledo, Ohio. Much of the development of the company is in single-phase motor construction. The new plant is operating at 100 per cent capacity and additions are being planned to increase production.

Republic Electric Company's New Building Completed

The new home of the Republic Electric Company, Cleveland, pictured here, has just been completed. In addition to the Cleveland headquarters the company maintains a branch at Akron and many agencies throughout the state, which are now capitalized at $250,000.

Primarily, the object in designing the plan of the building was to reduce to a minimum the operations ordinarily required in moving out shipments, and to this end a most efficient warehouse arrangement was adopted.

The stock is arranged in such a manner that relative parts are neighbors and orders may be prepared for shipment in a comparatively short time. The stock is moved about on trucks, and upon reaching the shipping room "foreign" deliveries are distinguished from "locals" and are segregated for loading and shipping in an effort to lessen handling. Unassembled packing cases bearing the company's name and shipping instructions make it possible to construct cases of proper dimensions to incase shipments securely and without waste. A loading platform and a spacious freight elevator contribute largely to the greater efficiency of the shipping room.



NEW BUILDING OF REPUBLIC ELECTRIC COMPANY

The systematic arrangement of the stock also permits a rapid inventory, and departmental stock cards are revised constantly by the department head, thus evolving an immediate or current inventory as well. These cards constitute a report to the purchasing department, which through their inspection and bearing in mind the requirements of the sales charts may replenish depleted stocks and prevent any overstock or shortage.

A prominent feature of the building is the customers' display room, fitted up and set apart for the use of patrons who wish to demonstrate or exhibit the company's products to their own customers. Since the company has recently included radio supplies in its distribution, the display room is equipped with a complete radio section. The room is provided with an inside aërial and box aërials, and in addition there is an antenna on the roof.

A service department for the repair and inspection of appliances also occupies a large and well-fitted room.

Excellent ventilation and utilization of daylight have produced favorable working conditions, and rest and recreation rooms with shower baths have enabled the company to retain satisfied and productive employees.

The building is constructed of fireproof materials throughout. The executive and sales offices occupy the front part of the first floor, while the bookkeeping and credit departments are in the same position on the second floor.

The officers are: L. Griesser, president; A. C. Kinzel, vice-president, and H. W. Allen, secretary and treasurer.

Large Broadcasting Station at Louisville Helps Radio

The establishment of the large broadcasting station of the Louisville *Courier-Journal and Times* has increased interest for amateur sets in Louisville territory. Sales have jumped at a tremendous rate as a result.

The Electric Supply & Equipment Company, 103 Allyn Street, Hartford, Conn., has placed a contract for a new branch plant at Broadway and Church Streets, Albany. The structure will be four stories high, 42 ft. x 60 ft., of brick construction, and will cost $50,000.

The Alpha Electric Company, 151 West Thirtieth Street, New York, has leased the building at 396-402 Eleventh Avenue, Newark, N. J., totaling about 50,000 sq.ft., and will occupy the structure for a distributing warehouse and service building. The rental totals $300,000.

The Central Manufacturing Company, Inc., 2521-29 Montgomery Street. St. Louis, Mo., manufacturer of electrically operated washing machines, contemplates the rebuilding of the portion of its plant destroyed by fire, Aug. 29.

The Reynolds Electric Company, Chicago, manufacturer of fractional-horsepower motors, announces in a sales bulletin recently issued that it is now manufacturing 500 motors a day.

The Shaw Insulator Company announces its removal to a new building at 148 Coit Street, Irvington, N. J.

The Economy Fuse & Manufacturing Company, Chicago, announces that it has removed its Detroit sales office from the Majestic Building to the First National Bank Building.

The Mutual Electric & Machine Company, Detroit, announces the appointment of Joseph H. Rohs as sales manager of its apparatus division.

The Ward Leonard Electric Company, Mount Vernon, N. Y., announces the appointment of Willis D. Bishop of Montreal as sales representative in the Province of Quebec. Mr. Bishop has been closely identified with the design, application and sale of control apparatus and switchboards since 1904.

Foreign Trade Notes

UNDERGROUND RAILWAY FOR KOBE, JAPAN, PROPOSED. — The first underground railway to be built in Japan may be in Kobe, the City Council having agreed to appropriate sufficient money to carry out the preliminary investigations. The proposed subway would extend from the eastern to the western boundaries of the city, about 5 miles. Extensions, according to the promoters, would be built as required.

INTEREST IN MOTOR-DRIVEN MACHINERY IN CHILE.—Interest in motor-driven machinery in Chile is constantly increasing, *Commerce Reports* states, owing to the intermittent fuel difficulties, which make electricity the most dependable form of power. The hydro-electric development which is under way near Santiago will emphasize this tendency. At present there is particular interest in catalogs of woodworking machinery, especially that equipped with electric motor drive. Both direct-current and alternating-current motors are used.

ELECTRIFICATION OF THE FRENCH RAILWAY SYSTEM.—The electrification of the entire French railway system has been decided upon, according to information recently given out by the French Minister of Public Works, *Commerce Reports* states, thereby reducing the running costs and doing away with the importation of foreign coal. Following an exhaustive inquiry, confirmed by the visit of a technical commission to the United States, the direct-current system of 1,500 volts has been adopted, and already various companies have begun work on the electrification of the more important sections. The three railway systems making the greatest progress are the Midi, the Paris-Orleans and the Paris-Lyons-Mediterranean. It is hoped to make the change within a few years on the Paris-Vierzon-Brive line, and also on the branches between Limoges, Montlucon, Gannat, Brive, Tulle and Cleremont-Ferran. This region is situated in the vicinity of the Dordogne River and its tributaries, on which, it is estimated, 400,000 kw. can be developed. The electrificatio.. of the Paris-Orleans and the Mediterranean railways will be rendered easy by the water power of the Rhone, the Alps and the central plateau. The electrification of 1,430 miles of its lines, or about 23 per cent, has been planned by this company. Within four years the line from Culoz to Modane will be electrified, as an experiment; later on stretches from Nice to Coni, Lyons to Marseilles and Ventimiglia, Lyons to Geneva, Lyons to Grenoble and the suburban lines about Paris will be operated by electricity.

New Apparatus and Publications

MOTOR DRIVE FOR ROLLING MILLS. —The English Electric Company, Ltd., Queen's House, Kingsway, London, W. C. 2, is distributing publication No. 372, which contains illustrations of various rolling-mill drives installed by the company.

ENGINEERING SERVICE. — Ophuls & Hill, Inc., 112 West Forty-second Street, New York City, mechanical, electrical and refrigerating engineers, is distributing a small booklet entitled "A $100,000-a-Year Supervising Engineer at Your Disposal," in which it describes its organization and methods of service.

RELAYS. — The General Electric Company, Schenectady, N. Y., is distributing bulletin No. 47,606, describing relays and their operation and general application.

HANDBOOK ON ELECTRIC EQUIPMENT.—The Electric Power Club, Kirby Building, Cleveland, has issued a new edition of its handbook covering substantially all the standardization in electric motors, generators, transformers, electric tools, mining and industrial locomotives, control equipment, switchboards and switching equipment manufactured in this country. It also contains definitions, symbols, general engineering recommendations and other information in connection with electric apparatus and control equipment.

PNEUMATIC COLLECTING AND CONVEYING SYSTEMS.—The B. F. Sturtevant Company, Hyde Park, Boston, has issued a seventy-two-page engineering bulletin on pneumatic collecting and conveying systems. It contains illustrations, diagrams and tables, how to find the size of fans, the suction, volume, r.p.m. and horsepower of any system, etc. Data are also given on dust collecting from grinding and polishing machines, coal breakers, etc., and the removal of fumes, gases, etc.

ASH DISCHARGE.—"The Rotary Ash Discharge" is the title of a booklet published by the American Engineering Company, Philadelphia, which covers its system of ash treatment and discharge.

GALVANOMETERS.—Bulletin No. 250, issued by the Roller-Smith Company, 233 Broadway, New York City, describes and illustrates its types "LGD" and "KGD" portable direct-current galvanometers.

CENTRIFUGAL PUMPS.—The Pennsylvania Pump & Compressor Company, Easton, Pa., has issued bulletin No. 202, covering its line of double-suction, single-stage centrifugal pumps.

STEAM TRAPS.—The Yarnall-Waring Company, Chestnut Hill, Philadelphia, is distributing bulletin T-1701, describing the "Yarway" steam traps.

MINE APPARATUS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued catalog 6-M, entitled "Westinghouse Line Material for Mines." It also contains information regarding mine locomotives, safety switches, etc.

SERIES-MULTIPLE TRANSFORMER. —The Kuhlman Electric Company, Bay City, Mich., is distributing bulletin No. 113 describing the "Kuhlman" disconnecting type series-multiple transformer for street lighting.

CRANKLESS ENGINES.—The Crankless Engines (Aus.) Proprietary, Ltd., 9 Queen Street, Melbourne, Australia, is distributing a booklet entitled "The Handbook of the Crankless Engine," covering its reciprocating engines, pumps, etc.

RADIO APPARATUS. — The Pacent Electric Company, Inc., 150 Nassau Street, New York City, has recently placed on the market a new amplifying transformer ("Audioformer") and a new "Pacent" universal detector stand.

ELECTRIC FURNACES.—The Electric Furnace Company, Salem, Ohio, is distributing two leaflets describing and illustrating various types of the "Bailey" elec-enameling, annealing and heat-treating furnaces.

RADIO HORN. — The American Art Maché Company, 6,311 North Clark Street, Chicago, has recently placed on the market a die-cast wood radio horn, known as the "Madera."

ELECTRIC PERCOLATOR. — A new "Hold-Heet" electric percolator has been placed on the market by the Russell Electric Company, 340 West Huron Street, Chicago.

GATE VALVE.—Bulletin No. 8-G issued by the Schutte & Koerting Company, Philadelphia, covers the "Schutte" regrinding swing gate valve, designed for steam pressures up to 300 lb. per square inch and 750 deg. F.

ELECTRIC HOISTS.—The Sprague Electric Works of General Electric Company, 527 West Thirty-fourth Street, New York City, describes the "Sprague" electric type WX hoists.

RADIO RECEIVING SET.—A new rectigon for charging batteries of radio receiving sets, known as "Radio-Type," is manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. It is also suitable for charging three-cell filament batteries of three-cell and six-cell automobile, starting and lighting batteries.

ELECTRIC BAKE OVEN.—A new automatic sectional-type electric bake oven has recently been perfected by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

New Incorporations

THE NEWBURG (MO.) LIGHT & POWER COMPANY has been incorporated by F. W. Shaw, B. F. Culbertson, E. J. Koch, A. E. Martin and J. H. Smith. The company is capitalized at $25,000 and proposes to supply electricity in Newburgh and adjacent territory.

THE NEW ORLEANS (LA.) PUBLIC SERVICE COMPANY has been incorporated with a capital stock of $5,000 for the purpose of distributing electricity and gas for lighting and power purposes. A. L. Kempster is general manager.

THE IMBODEN (ARK.) HYDRO-ELECTRIC POWER & MANUFACTURING COMPANY has been organized with a capital stock of $100,000. The officers are: W. R. Lane, president; L. F. Wheeless, vice-president; W. L. Bugg, treasurer, and G. G. Dent, secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

NORWAY, ME.—The Maine Power Company will install new equipment at its local hydro-electric power plant, including waterwheel, generator and auxiliary machinery. A portion of the main transmission line in the vicinity of Lewiston will be rebuilt.

WAVERLY, MASS.—A power house, 75 ft. x 78 ft., will be constructed at the local School for Feeble-Minded. C. H. Tenney & Company, Boston, Mass., are architects.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company plans the erection of a fuel-oil tank of 1,540,000 gal. capacity on Tallman Lane, near the Providence River, Providence, in the near future.

STAMFORD, CONN.—The Stamford Hall Company, Willow Street, is remodeling its power plant and installing new boilers at a cost of about $5,000.

Middle Atlantic States

TRENTON, N. J.—The Magnetic Pigment Company, Cass Street, will build a power house addition in connection with its proposed factory extension, estimated to cost $50,000.

RUNNEMEDE, N. J.—The Public Service Electric Company is extending its system to Runnemede.

READING, PA.—The Metropolitan Edison Company has arranged for a preferred stock issue, part of the proceeds to be used in connection with the acquisition of the properties and holdings of the York Haven Power & Water Company and the York Haven Electric Transmission Company, both of York Haven.

PHILADELPHIA, PA.—The Philadelphia Suburban Gas & Electric Company has issued bonds for $400,000, a portion of the proceeds to be used for extensions and improvements.

YORK, PA.—C. R. Gilbert, Superintendent of the Wrightsville Light & Power Company of Wrightsville, Pa., is now making preparation to extend the pole line and light wires to East Prospect Borough, a distance of 4 miles south.

CHESTER, PA.—The installation of a new lighting system on Edgmont Avenue is under consideration. Plans have been submitted by the Delaware County Electric Company.

LANCASTER, PA.—The American Telephone & Telegraph Company has applied to the Public Service Commission for permission to install a local underground conduit system.

MORRISVILLE, PA.—The light committee plans for the installation of a number of 600-cp. arc lamps.

MOUNTAIN TOP, PA. — The Pennsylvania Power & Light Company will extend its transmission lines here, making connection at Ashley, Pa. A local distributing system will be installed.

ROCKWOOD, PA. — The Youghiogheny Power & Electric Company has plans under way for the construction of a hydro-electric power plant on the Youghiogheny River, near Oakland, Md. Other plant units will be installed on the Muddy and Deep Creeks in the same district. Application has been made to the Maryland Public Service Commission.

TOPTON, PA.—The Topton Electric Light & Power Company is extending its transmission lines from the borough limits to Ringtown and Oreville.

BESSEMER, PA.—The Nashville Bridge Company, Nashville, Tenn., contemplates the construction of a power plant in connection with its proposed steel fabricating plant here. A site of 14 acres has been purchased.

BALTIMORE, MD.—The Bethlehem Steel Company, Bethlehem, Pa., will build a 10,000-kw. steam turbo-generator power plant at its local steel mills at Sparrows Point, in connection with plant extensions, to cost in excess of $3,000,000.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company has

issued bonds for $5,000,000, a portion of the proceeds to be used for extensions and improvements.

HARRISONBURG, VA. — Contract has been let to Tucker & Laxton, Charlotte, N. C., for the construction of a municipal steam-operated electric power plant for auxiliary service, estimated to cost about $80,000. A list of equipment for installation is being arranged.

RICHMOND, VA.—Bids will be received by the Department of Utilities until Sept. 25 for the construction of a municipal power plant, with capacity of about 1,800 hp.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Oct. 10 for 60,000 ft. of incandescent lamp cord and 40,000 ft. of lighting and power wire, for use at the Mare Island Navy Yard, Cal. (Schedule 150).

North Central States

MOUNT CLEMENS, MICH.—The Detroit Edison Company will soon commence the construction of a local substation to cost about $150,000.

ISLAND, KY.—The Douglas Coal Mining Company, 504 Fourth Street and First National Bank Building, Nashville, Tenn., will install motors, controllers and other electrical equipment at its properties here.

HAZARD, KY.—The Kentucky & West Virginia Power Company, a $6,000,000 corporation, has taken over the Daniel Light & Power Company, Whitesburg, Ky., and will install an enlarged new plant connecting directly with its big central plant at Lothair, Ky. The consideration was not made public.

HAZARD, KY.—The Kentucky & West Virginia Power Company will extend its transmission lines to Walkertown and Allais, beginning construction at once.

LOUISVILLE, KY.—The Louisville Gas & Electric Company will commence the immediate construction of a one-story cable house, 100 ft. x 100 ft., with extension, 20 ft. x 300 ft., estimated to cost about $1,000,000, including equipment.

PIKEVILLE, KY. — The Pike Light & Power Company has increased its capital from $50,000 to $200,000 and will make enlargements, it is announced.

MARTINS FERRY, OHIO. — Plans are being prepared for a municipal light and power plant in connection with waterworks improvements, estimated to cost about $450,000. G. L. Grogan is clerk.

BELLEVILLE, ILL. — The Southern Illinois Light & Power Company is securing the right-of-way for a transmission line between Belleville and New Athens. This company now serves 100 cities and towns in southwestern Illinois.

GRAND TOWER, ILL. — The Central Illinois Public Service Company will soon take bids for the construction of its proposed hydro-electric power plant on the Mississippi River here, estimated to cost close to $2,000,000. Sargent & Lundy, 72 West Adams Street, Chicago, are consulting engineers.

NORMAL, ILL.—Bids will be received by C. R. Miller, chairman Public Works and Buildings, Springfield, Ill., until Sept. 26 for the construction of a one-story power house at the State Soldiers and Orphans' Home here, 79 ft. x 90 ft. Edgar A. Martin, 410 South Wabash Avenue, Chicago, is architect.

PETERSBURG, ILL. — The Central Illinois Public Service Company has purchased the Abbott light and power plant at Petersburg for a reported consideration of $250,000. The Abbott plant supplied Petersburg, Ashland, Pleasant Plains, Tallula, Greenview, Athens, Middleton, New Holland, Easton, Mason City and San Jose, all towns in central Illinois. I. R. Abbott, who developed the property, will continue management of the plant. A transmission line will be built from Virginia, Ill., to Ashland, Ill., where it will connect with the transmission line of the Central Illinois Public Service Company from the hydro-electric plant at Keokuk, Iowa.

RUSSELLVILLE, ILL. — The Arkansas Light & Power Company will start work soon on the reconstruction of its power dam on the Illinois River near Russellville, Ill. Modern water turbines and generators for the development of 800 hp. of electricity will be installed.

EMMETT, IDAHO.—Work has started on the government diversion dam and power plant on Black Canyon. To secure electricity to operate the machinery a transmission line will be erected from the Emmett substation to the dam. The cost of the project is estimated at $1,500,000.

SIOUX CITY, IOWA.—A merger of the Sioux City Service Company with the Sioux City Gas & Electric Company has been approved at a special election. Extensions and improvements will be made in the consolidated system.

BRIGHAM CITY, UTAH.—A new electric feeder line is being erected from the new municipal electric plant at the mouth of Box Elder Canyon to Eighth West Street. The distribution system will be reconstructed in some parts of the city in the near future. It is proposed ultimately to rebuild the entire system.

LEVAN, UTAH.—The town of Levan has entered into a contract with the Big Springs Power Company, Fountain Green, for furnishing electricity for lamps and motors in Levan. Bonds to the amount of $16,000 have been voted to establish an electric service here.

ELKHART, IND.—The American Gas & Electric Company, New York, has acquired property of the Indiana & Michigan Electric Company. Extensions and improvements, it is understood will be made.

EAU CLAIRE, WIS.—Contract has been awarded by the Dells Paper & Pulp Company to the C. R. Myers & Sons Company, Oshkosh, for a 1,000-hp. hydro-electric plant, to cost about $165,000.

MADISON, WIS.—The Wisconsin Light & Power Company has been granted permission by the Railroad Commission to issue $163,700 in bonds, the proceeds to be used for erection of a high-tension line from Fond du Lac, Beaver Dam and Dane.

HARTFORD, WIS.—The Utilities Department will erect a 20-ft. x 25-ft. brick and cement block addition to its present power plant, which when completed will be utilized in housing equipment.

KENOSHA, WIS.—A new lighting system will be installed by the Wisconsin Gas & Electric Company in Library Park, as well as the substitution of high-power lights and ornamental iron poles for the arc lights and wooden poles.

NEW LONDON, WIS. — Among many other improvements this fall will be the installation of an ornamental lighting system throughout the city.

CALEDONIA, MINN.—Contractors have already started on the construction of an auxiliary power plant for the Root River Power Company. The plant is to be erected by a Preston (Minn.) firm and will be a 50-ft. x 30-ft. cement-block structure located on land recently purchased for that purpose.

KANSAS CITY, MO.—The Kansas City Power & Light Company has issued bonds for $21,000,000, a portion of the proceeds to be used for extensions and improvements, including enlargements to the Northeast power plant to increase the capacity from 60,000 kw. to 90,000 kw.

HASTINGS, NEB. — Bids will soon be asked for extensions and improvements in the municipal power plant, estimated to cost about $20,000. The K. H. Gedney Company, Hastings, is architect.

OMAHA, NEB. — The Nebraska Power Company has issued bonds for $3,500,000 a portion of the proceeds to be used for extensions and improvements.

PITTSBURGH, KAN.—The Kansas City Southern Railroad Company, Kansas City, Mo., will build a power plant in connection with its proposed new car and locomotive shops here to cost about $1,500,000.

Southern States

DAVIDSON, N. C.—Bonds for $60,000 are being arranged for extensions and improvements in the electric lighting system and waterworks.

ELIZABETH CITY, N. C.—The Council has tentative plans under consideration for the construction of a new municipal electric plant in connection with proposed waterworks. Bonds for $750,000 will be arranged.

JACKSONVILLE, FLA. — The Kreiss Process Products Company, 205 Graham Building, recently organized, contemplates the installation of a power house in connection with its proposed local fertilizer manufacturing plant. William B. Taber is manager.

KNOXVILLE, TENN. — The Tennessee Power Company has been granted permission to issue bonds for $250,000 to defray in part the purchase of a transmission line to Maryville, about 16 miles.

FAYETTEVILLE, ARK. — The Spees Vinegar Company will build a new power house at its local factory. Headquarters are at Kansas City, Mo.

STEPHENS, ARK. — Preparations are being made by the Stephens Light & Power Company for the installation of a new electric light plant. L. B. Bracken is president.

SEARCY, ARK.—The city will install an ornamental lighting system in the business district, totaling about 10 blocks. Service will be furnished by the Searcy Light & Water Company.

STEPHENS, ARK.—The Stephens Light & Power Company will soon take bids for the erection of a one-story power plant on the local site. Archer & Company, Kansas City, Mo., are engineers.

WALNUT RIDGE, ARK.—The Central Power & Light Company will make improvements in its local power plant and install new equipment.

BIRMINGHAM, ALA.—The installation of an ornamental lighting system on Fifth Avenue, to cost about $12,000, is under consideration by the Civitan Club. Y. Whitman is chairman.

MOBILE, ALA.—Bids will be received at the United States Engineer Office until Oct. 10 for a 100-ft. Diesel electric towboat, with equipment to include main engines, generators, exciters, switchboard, main motor, reduction gear, pumps, etc.

COLLINS, MISS.—A bond issue of $30,000, recently voted, has been sold, the proceeds to be used for the installation of a municipal electric system and improvements in the water plant.

NEW ORLEANS, LA. — The Citizens' Light & Power Company has plans in preparation for the erection of a one-story addition to its power plant on Carrollton Avenue, estimated to cost about $200,000, including machinery.

BLISS, OKLA. — Bonds have been approved for the installation of a municipal electric lighting system. Plans will be prepared at once.

MORRISON, OKLA. — A bond issue is being arranged for the installation of a municipal distributing system.

VINITA, OKLA.—Plans are being completed for the construction of a municipal hydro-electric plant on the Grand River, near Ketchum.

ABILENE, TEX.—The West Texas Utility Company, operated by the American Public Service Company, will make a number of extensions in its transmission system and will install distributing lines in towns throughout this district.

AMARILLO, TEX.—The Board of City Development has awarded a contract for installation of ornamental light standards and electric lights along two more blocks of the downtown streets.

CHILDRESS, TEX.—The Childress Electric Light & Ice Company, owned by the Central Texas Power Company, will be enlarged and made into a district generating plant, according to Frank Houston, district manager. It is planned to enlarge the Childress plant to supply energy for a number of the nearby towns, building high lines to the towns to be supplied. Improvements contemplated at Childress include a new building to take the place of the present wooden and sheet iron structure, the installation of new 75-hp. oil-burning boilers and direct-driven turbine generators. The improvements will cost in excess of $100,000. Work was started last week on the concrete foundation for the engine and generators.

DALLAS, TEX.—The Missouri, Kansas & Texas Railroad has preliminary plans in progress for the electrification of its lines between Dallas and Denton, Tex. Application has been made by John W. Everman, supervisor of public utilities, for approval.

DALLAS, TEX. — The Texas Power & Light Company is arranging a fund of $500,000, the proceeds to be used for extensions and improvements in different parts of the state.

MERCEDES, TEX.—Arrangements have been made by the Mercedes Light, Water & Power Company for extensive improvements, including a new power house, additional machinery and filtration plant.

HASKELL, TEX.—The West Texas Utilities Company, Abilene, contemplates extending its transmission lines to Haskell, Tuscola, Albany and vicinity.

KOSSE, TEX.—The Kosse Light & Power Company contemplates installing additional equipment in its plant.

CORSICANA, TEX.—The Corsicana Electric Light Company is making estimates of cost for an underground conduit system in the business district.

DALLAS, TEX. — The Dallas Power & Light Company has plans nearing completion for the installation of an ornamental lighting system on Pacific Avenue, including the installation of an underground conduit system for all overhead lines, estimated to cost $110,000.

KOSSE, TEX.—The Humphreys-Pure Oil Company will build a large electrically operated pumping plant at its new properties in this section. Headquarters are at Mexia, Tex.

Pacific and Mountain States

ABERDEEN, WASH.—The Council plans for the installation of an ornamental lighting system on the principal streets.

PATEROS, WASH.—The Okanogan Valley Power Company plans for the immediate rebuilding of its local power plant, recently destroyed by fire.

OAKLAND, CAL.—Surveys are being made for the proposed ornamental lighting system on the shores of Lake Merrit. It is estimated that 325 lamp poles will be required.

PACIFIC GROVE, CAL.—The city trustees have appfoved plans for the installation of an ornamental lighting system on Lighthouse and Forest Avenues. H. D. Severance, city engineer, in charge.

LOS ANGELES, CAL.—Bids will be received by the Public Service Commission until Sept. 29 for a quantity of 35,000-volt cable. James P. Vroman is secretary. (Specification P-276).

SAN PEDRO, CAL.—Work has begun on the foundation on the new substation to be erected at Harbor Boulevard and Regan Street. Electricity will be supplied from Los Angeles at 33,000 volts. The cost is estimated at about $300,000.

DILLON, MONT.—The Montana Power Company has completed surveys for its proposed power line here. Equipment and cost are being estimated.

DENVER, COL.—Motor-driven machinery will play a large part in the $500,000 plant of the Myers Pulp & Paper Company now being constructed. The mill will produce board and container stock, wallboard and sheeting paper, and it will be a reclamation market for cast-off paper.

DENVER, COL.—Announcement has been made of the early construction of a ten-story office building as a memorial to the late Thomas M. Patterson, at a cost of $500,000, by Lovejoy & Erewen, local architects.

DENVER, COL.—Extensive additions to the ornamental street lighting of the city will be made in the letting of contracts for new units to be used on the Broadway extension and several of the streets in the lower part of the city, at a cost of about $100,000. The city engineer's office is working out the details.

ENGLEWOOD, COL.—The General Iron Works Company, representing the Consolidated Foundry & Iron Works interests of Colorado, has purchased 18 acres adjoining the Denver County line on which a plant costing $750,000 will be constructed early in the summer. T. B. Stearns of the Stearns-Rogers Manufacturing Company is directing the developments in the organization.

ARTESIA, N. M.—The Council has perfected plans for a municipal electric light and power plant.

Canada

ELKO, B. C.—The Wigwam Pulp & Paper Company will build a power plant in connection with its new local paper and pulp mill, estimated to cost in excess of $5,000,000.

VANCOUVER, B. C.—Bids have been called for by the Harbor Board for the supply and installation of a complete electrical equipment and cargo-lifting plant for the new $2,000,000 Ballantyne Pier. The equipment includes semi-portable electric cranes, electric freight elevators, electric escalators, electric capstans, tractors and trailers. A. D. Swan, harbor engineer of Montreal, is consulting engineer for the Harbor Board. It is roughtly estimated that the equipment will total in the neighborhood of $250,000. Bids will be received up to noon of Oct. 2.

Mexico

PUEBLO, MEXICO—Surveys have been made for a large hydro-electric plant which is to be built on the Sequixquine River, State of Teaxcala, by William O. Jenkins, United States Consular Agent at Puebla. Mr. Jenkins has obtained a concession from the Mexican government for the proposed plant. It is stated that power transmission lines will be built to towns and industries in a wide scope of territory surrounding the new plant.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 29, 1922)

1,427,695. SWITCHBOARD CALL-SIGNAL APPARATUS AND CIRCUITS; R. W. Morris, Roslyn, N. Y. App. filed March 15, 1919. Arranged to prevent several operators from answering same call.

1,427,718. ACTUATING MECHANISM FOR MAGNETOS; P. Brown, Springfield, Mass. App. filed June 25, 1920. Reciprocatory make-and-break type for gas engines.

1,427,725. SWITCHBOARD CALL SIGNAL APPARATUS AND CIRCUITS; L. W. Cooper, Brooklyn, N. Y. App. filed March 15, 1919. Facilitates answering of incoming calls.

(Issued Sept. 5, 1922)

15,444 (reissue). ENGINE STARTER; F. E. Fisher, Detroit, Mich. App. filed April 2, 1917. Combined starting and lighting apparatus for automobiles.

1,427,779. DISTRIBUTING BOARD FOR ELECTRIC HOUSE INSTALLATIONS; M. Breitner, Halle-on-the-Saale, Germany. App. filed Sept. 16, 1920. Meter and safety fuse board.

1,427,783. AIR-COOLED TRANSFORMER; J. Burke, Erie, Pa. App. filed Nov. 6, 1919. Electric fan at top draws air through coils.

1,427,814. ELECTRIC FURNACE; E. H. Horstkotte, Schenectady, N. Y. App. filed May 3, 1920. Resistance furnace with electrodes of cupped carbon disks.

1,427,816. TREATMENT OF ZIRCONIUM ORES; Otis Hutchins, Niagara Falls, N. Y. App. filed Sept. 22, 1920. Producing pure zirconium by reducing ore in electric furnace.

1,427,832. RADIO TELEPHONY; F. S. McCullough, Cleveland, Ohio. App. filed July 7, 1919. Transmission system consisting of spark gap, electric arc and modulating circuit.

1,427,833. RADIO TELEGRAPHY; F. S. McCullough, Cleveland, Ohio. App. filed Aug. 2, 1919. System for determining direction of distant transmitting stations.

1,427,870. HERMETICAL SEAL; W. L. Van Keuren, North Bergen, N. J. App. filed June 15, 1918. For miniature-lamp leading wires.

1,427,875. MEANS FOR SUSPENDING PLATES DURING TREATMENT BY ELECTROLYSIS; R. M. Weeks, Narberth, Pa. App. filed Feb. 5, 1921. Process of electrical etching.

1,427,876. APPARATUS FOR ELECTRICAL ETCHING; R. M. Weeks, Narberth, Pa. App. filed April 2, 1921.

1,427,877. PROCESS AND APPARATUS FOR ELECTRICAL ETCHING; R. M. Weeks, Narberth, Pa. App. filed April 25, 1921.

1,427,883. ELECTRIC LAMP LOCK; H. E. Williams, Washington, D. C. App. filed Oct. 17, 1918. To prevent the unwarranted removal of lamp.

1,427,908. SURGICAL BAKER; L. Perlman, Philadelphia, Pa. App. filed Aug. 28, 1920. Heating device for treating the body.

1,427,911. PLASTIC COMPOSITION; L. T. Richardson, Milwaukee, Wis. App. filed Dec. 24, 1917. Insulating material composed of heat-treated pitch and asbestos.

1,427,919. PROCESS FOR ELECTRICALLY MANUFACTURING COMPACT METALLIC BERYLLIUM; A. Stock, Berlin-Dahlem, and H. Goldschmidt, Berlin, Germany. App. filed May 12, 1922. Beryllium produced by electrolyzing alkaline earth fluoride and beryllium compound.

1,427,923. TELEPHONE-CALL CIRCUITS; J. G. Toomey, New York, N. Y. App. filed April 21, 1920. Pertains to call circuits between two exchanges.

1,427,953. ATTACHING DEVICE; A. W. Harrison, Winthrop, Mass. App. filed June 6, 1918. Nail through knob for electrical work split to hold pieces together.

1,427,970. SECONDARY BATTERY; G. W. Pleis, Sr., and G. W. Pleis, Jr., Philadelphia, Pa. App. filed June 8, 1921. Formation of electrodes.

1,428,022. ADVERTISING DEVICE; C. Fleck, Cleveland, Ohio. App. filed Jan. 7, 1921. Motor intermittently drives apron to predetermined positions for display.

1,428,033. RECORDING TELEGRAPH MACHINES; J. A. Hulit, Chicago, Ill. App. filed May 22, 1919. Means for connecting pen in recording telegraph machine.

1,428,049. ELECTROLYTIC APPARATUS AND METHOD OF DEPOLARIZING THE SAME; W. D. Nickum, Glendale, Cal. App. filed Feb. 8, 1919. Dissipates deterrent gas film formed by electrolysis of water.

1,428,050. ELECTROLYTIC APPARATUS AND METHOD OF DEPOLARIZING THE SAME; W. D. Nickum, Glendale, Cal. App. filed April 21, 1920. Maintains current of substantially uniform strength.

1,428,057. PRODUCTION OF LOW-CARBON FERROALLOYS; N. Petinot, New York, N.Y. App. filed Sept. 26, 1919. High carbon ferroalloys melted in acid-lined electric furnace.

1,428,061. MANUFACTURE OF IRON AND STEEL; T. Rouse, Stamford Hill, England. App. filed Nov. 23, 1920. Smelted in electric furnace.

1,428,062. ELECTRIC DISTRIBUTOR FOR SEALING WAX; H. Sanglier, Paris, France. App. filed Dec. 23, 1920. Electricaly heated pot with plunger to operate outlet.

1,428,071. ELECTRIC HEATER; P. J. H. Bernard, Montreal, Quebec, Can. App. filed Dec. 9, 1920. Electric radiators for supplanting steam, water or hot-air heating systems.

1,428,083. MAGNETO; H. F. Geist, Hartsville, S. C. App. filed Oct. 30, 1920. Armature-wound type.

1,428,133. CURRENT COLLECTOR FOR RAILWAY VEHICLES; R. Bienvenoe and J. Bienvenoe, Paris, France. App. filed April 15, 1920. Metal ring fastened to but insulated from car wheel collects current from flexible contact rail.

1,428,155. MEANS FOR SIGNALING OVER MULTIPLEX TRANSMISSION CHANNELS; L. Espenschied, Hollis, and H. A. Affel, Brooklyn, N. Y. App. filed July 29, 1919. Provides means whereby ringing and other signals may be transmitted for each carrier channel.

1,428,156. LOW-FREQUENCY AMPLIFIER; L. Espenschied, Hollis, N. Y. App. filed Sept. 26, 1919. Amplifies ocean-cable telegraph signals or vibrations emanating from propeller in submarine detection.

1,428,157. ELECTRIC WATER HEATER; A. Fisher, New York, N. Y. App. filed March 22, 1922. Instantaneous heater in which water is heated when faucet is opened.

1,428,178. DEHYDRATOR; W. Meredith, Alameda, Cal. App. filed Oct. 28, 1920. Motor-operated electrode.

1,428,227. ELECTRIC SOLDERING IRON; J. T. Griffin, Oak Park; W. A. Timm, Berwyn, and A. E. Santschi, Cicero, Ill. App. filed Oct. 16, 1920. Self-supporting heating element within soldering head.

1,428,233. ELECTRIC SADIRON; J. A. Howard, Sr., West New Brighton, N. Y. App. filed June 4, 1920. Electrically heated rollers form bearing surface.

1,428,237. CALL BELL ON SIGNALING DEVICE; S. Katz, Chicago, Ill. App. filed May 24, 1919. Bell hammer and buzzer may be actuated to give three different signals controlled from three circuits.

1,428,262. METHOD OF WORKING ELECTRIC RESISTANCE WELDING MACHINES OPERATING WITH CONTINUOUS CURRENT; E. Schroder, Berlin, Germany. App. filed Jan. 13, 1917. Gas-filled interrupters of turbine type interrupt currents without sparks.

1,428,277. MUSIC-ROLL PERFORATOR AND PRINTER; J. J. Davilla, New Orleans, La. App. filed June 13, 1921. Punching device electromagnetically actuated from keyboard of instrument.

1,428,305. ATTACHMENT FOR TELEPHONE TRANSMITTER; F. Sutherland, Chicago, Ill. App. filed Aug. 3, 1921. Device closes transmitter while receiving communications.

1,428,323. COMPENSATING DEVICE FOR REACTION TUBES; C. M. Colvin, Kansas City, Mo. App. filed June 6, 1921. For electrochemical apparatus manufacturing hydrocarbons.

1,428,342. BRUSH MOUNTING; J. D. Nies, St. Charles, Ill. App. filed April 27, 1921. Brush in insulated holder to prevent leakage of current.

1,428,349. HEATING DEVICE; M. J. Whelan, Clifton Heights, Pa. App. filed Feb. 17, 1922. Heating device for submersion in liquid to be heated.

1,428,374. CORROSION-RESISTANT CONDUIT FITTING; E. L. Huff, Natrona, Pa. App. filed Feb. 25, 1919. Consists of 90 per cent lead and 10 per cent antimony.

1,428,379. PASTEURIZER; Y. Kokusho, Philadelphia, Pa. App. filed Oct. 14, 1920. Milk heated by current passing directly through it.

1,428,424. ELECTRIC ADVERTISING SIGN; O. Fehler, Berlin-Steglitz, Germany. App. filed Oct. 12, 1920. Lamp filament wound to form legend of sign.

1,428,489. ELECTRIC ENGINE; H. Mace, Sidewood, Saskatchewan, Can. App. filed Feb. 6, 1920. Reciprocating engine with armature placed in two electromagnets.